Modern Refrigeration & Air Control

Vol. 62 No. 740 NOVEMBER, 1959 Price 2s. 6d. monthly

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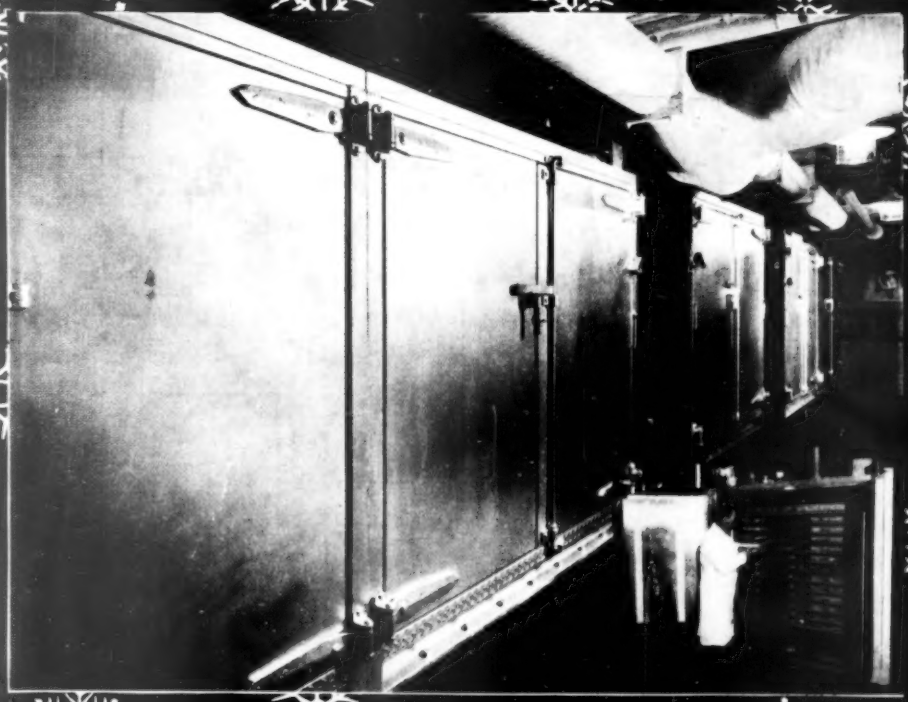

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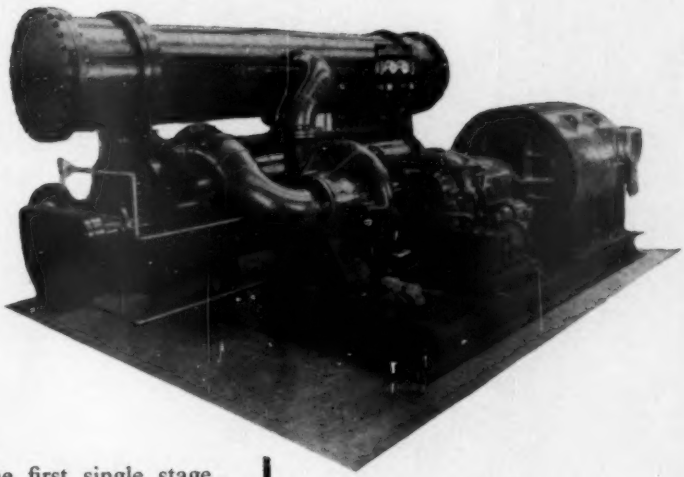

What are believed to be the first single stage turbo compressor water chilling systems to be exported from Great Britain to the Middle East left recently for Kuwait Oil Company's new hospital.

Two entirely self-contained turbo packaged water cooling systems were designed, with special consideration given to the problems arising from insufficient fresh water supplies and the necessity of using sea water for cooling. Each system is rated to cool 875 gallons per minute, which represents a heat removal rate of 4.2 million B.Th.U's per hour.

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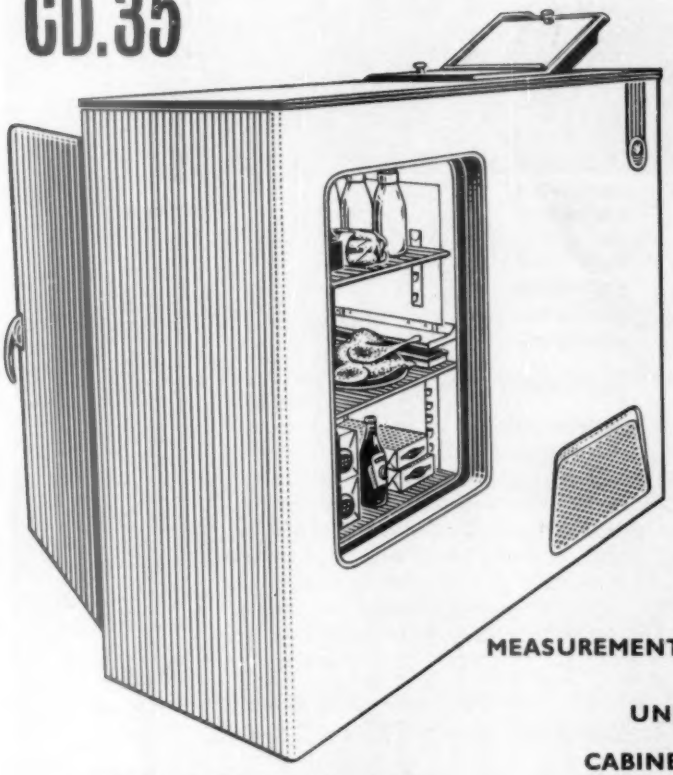
The NEW *Lec*
DUAL-PURPOSE FROZEN FOOD CABINET
CD.35



shows goods better

keeps food fresher

This new dual-purpose cabinet displays your goods and has a cold storage unit attached. This unit holds up to 120 lb. of frozen food, whilst the fully adjustable shelves in the display unit allow you to show a maximum of goods in the minimum of space.

MEASUREMENTS : Height 41¾", Width 54", Depth 21¼"
5.2 cu.ft. illuminated display.
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UNIT : *Lec* hermetically sealed murmur-quiet Silometic unit guaranteed 5 years.

CABINET : All steel, including new type evaporator in display compartment ; warranty 1 year.

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"OPINION"

TIMBER IN INSULATION

In case you have not heard of 'Poria', a sister to 'Coniophora', we would introduce you.

Whereas 'Coniophora' is a form of wet rot which may develop from spores built in with timber used for burying in insulation 'Poria' is a spontaneous development which attacks all softwoods and many of the hardwoods used in the construction of frames, panels, etc. for Low Temperature Cold Stores. The highest quality timber will suffer. You cannot ensure against this adequately by pressure treatment of timber with so-called rot preservatives for any length of time. The best quality timbers will only allow a surface penetration, whereas those timbers which permit a full penetration, and consequent protection, are the soft varieties which twist and warp.

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Sylvian (REG'D)

A universal Serviceable *Sealed Unit with* UNIQUE *features*

- ★ LOWER TEMPERATURE MEANS REAL DEEP-FREEZE
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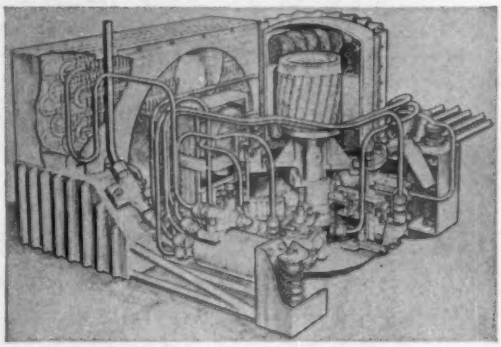

British Patent
UK 680922

Australian Patent
154195

U.S.A. Patent
2738122

New Zealand Patent
105246

While having the advantages of effective "Sealing" this Unit offers every facility for complete testing, maintenance or repair on the spot by ordinary Service Engineers using simple tools. Costly periods of enforced idleness are thus avoided. A special feature of the design is the interlock of main casings, giving exceptional rigidity, and long, trouble-free life. Readily adaptable to a wide variety of mountings it provides an efficient component, as original or replacement, over a large field of operation.

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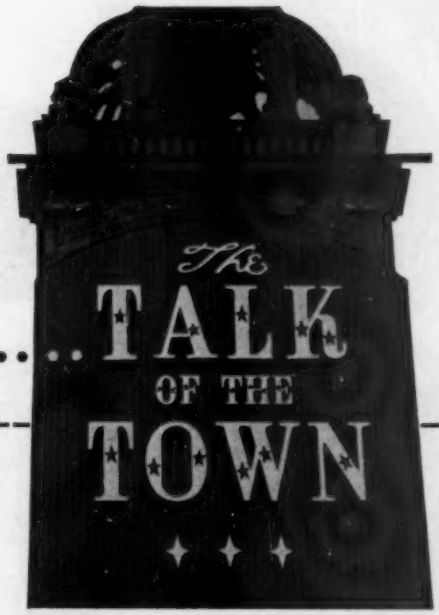
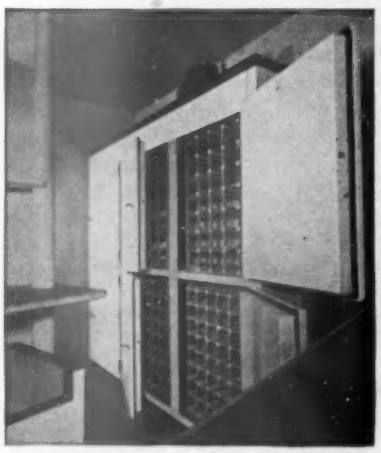
How FRIGIDAIRE helped make the Hippodrome...

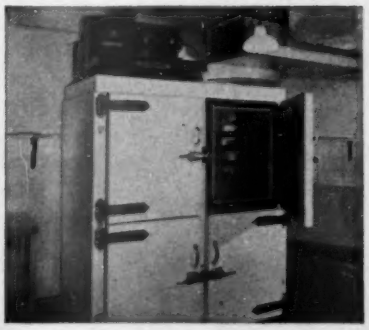


Frigidaire has played an important role in converting the London Hippodrome *from top to bottom* into an up-to-date theatre-restaurant . . . "The Talk of the Town!" The extensive modern refrigeration equipment supplied incorporates no less than seventeen Frigidaire condensing units.



FRIGIDAIRE FOR THE BALCONY!

The kitchen on this floor is very fully equipped with special Frigidaire service cabinets designed for quicker, more efficient service. In the balcony bar, there is a special wine-cooling cabinet and also a standard beverage cooler.



FRIGIDAIRE ON THE GROUND FLOOR!

The kitchen on this floor—for serving diners on ground floor level—contains two standard upright service cabinets, besides a stainless steel cabinet with service compartments for cooling salads, hors d'oeuvres, smoked salmon, ice cream, etc. The bar on this floor, too, is equipped with a special wine-cooling cabinet.

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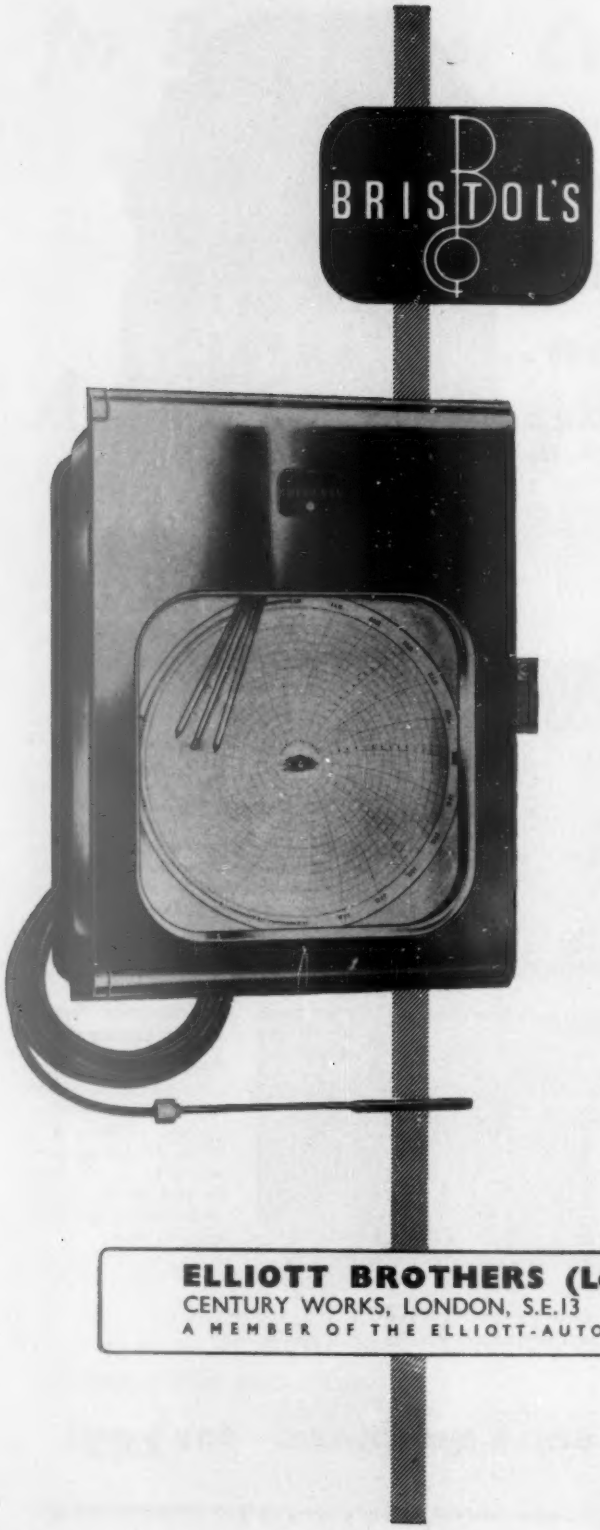

BLOOD BANK RECORDING THERMOMETERS

"A blood bank refrigerator, not equipped with a constant recording thermometer, may go off during the night because of power failure. Power is restored, but not until after the blood has become warm. The blood is recooled and the hemolysis that occurs when the red cells are brought to body temperature at the time of transfusion may not be detected unless a sample is centrifuged. Severe hemolytic reactions may therefore result."—CARL V. MOORE, M.D., The Journal of the American Medical Association.

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- PROTECTION AGAINST FREEZING OF BLOOD BANK due to refrigerator thermostat failure.
- A WARNING OF DANGER when the temperature deviates from the safe range.
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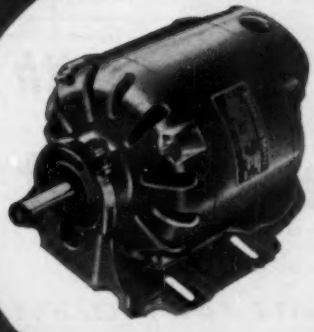
Before you start work on your plans for refrigeration applications which call for compact, high-efficiency electric motors . . . consult Delco Motor engineers. The Delco range includes motors to meet most modern requirements. These versatile motors are so designed as to be easily adapted to suit your individual needs.

DELCO 650 Type



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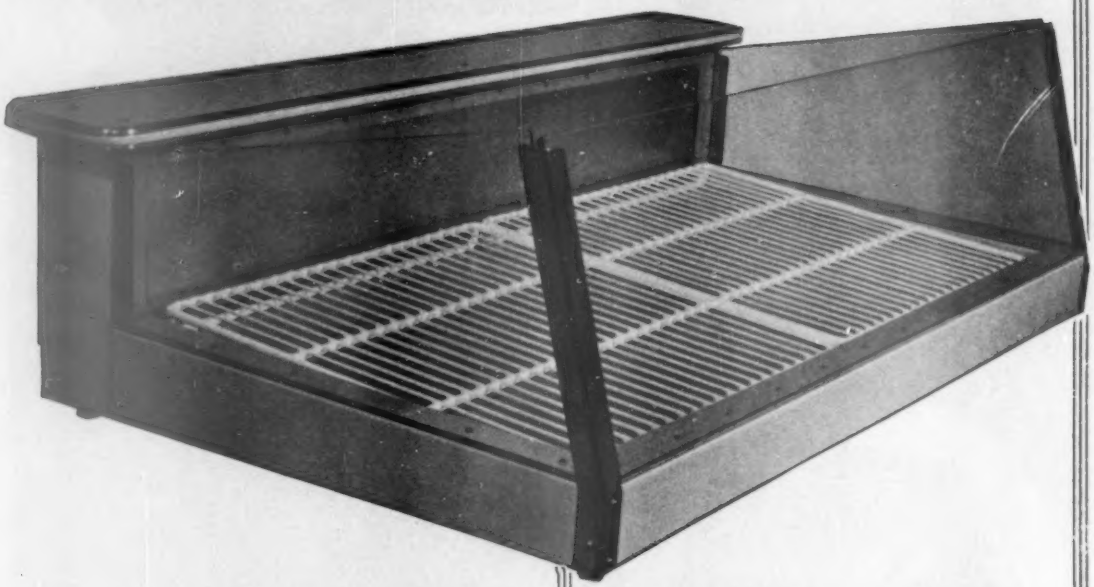

MODEL P2

for use with

remote unit

PRODUCED TO HELP MEET RISING DEMANDS, THIS SHOW CASE INCORPORATES ALL THE FEATURES ESSENTIAL TO HIGH EFFICIENCY, COUPLED WITH EASE OF INSTALLATION AND MAINTENANCE

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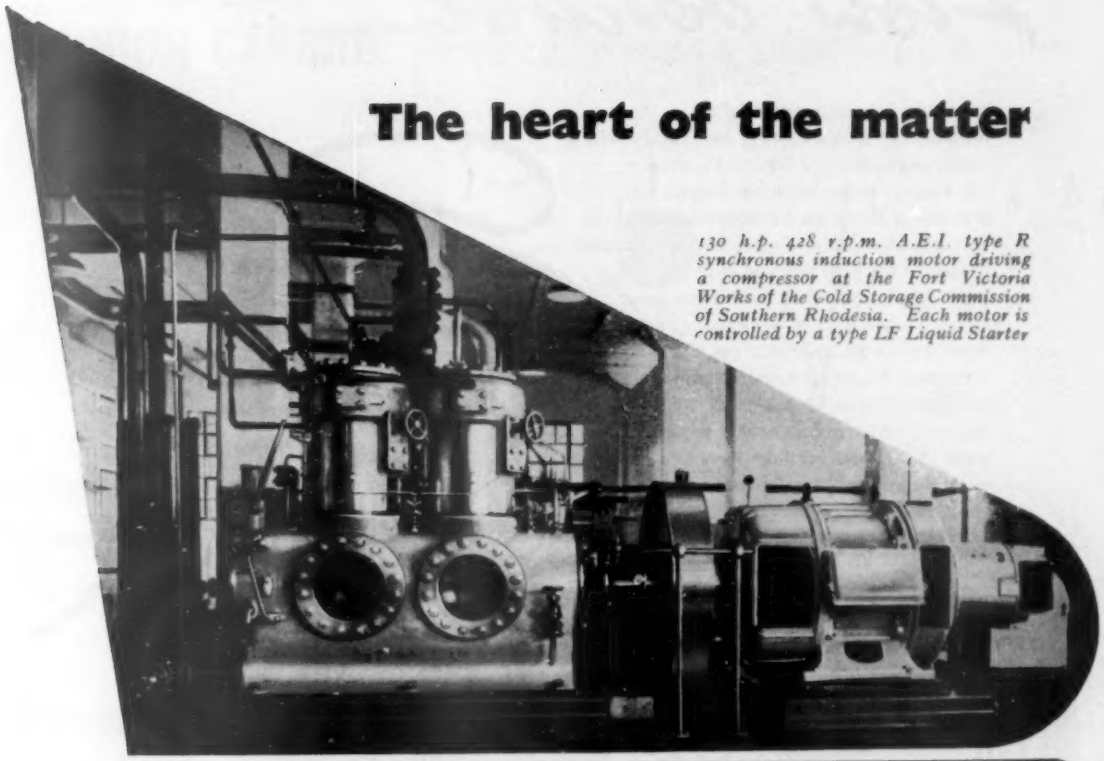
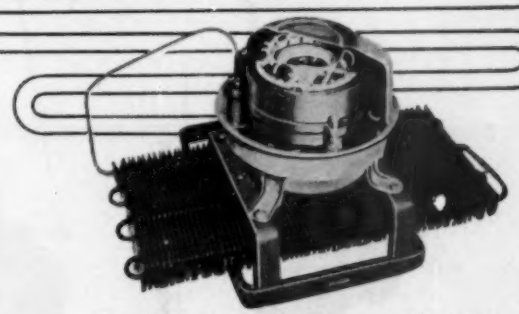
The heart of the matter



130 h.p. 428 r.p.m. A.E.I. type R synchronous induction motor driving a compressor at the Fort Victoria Works of the Cold Storage Commission of Southern Rhodesia. Each motor is controlled by a type LF Liquid Starter

In refrigerating plant it's the motor that matters. A.E.I. motors are designed by engineers with first-hand knowledge of the refrigeration industry. They do not stop at B.S. Specifications. Maximum reliability with minimum maintenance is the specification followed. Whatever the size of refrigerating plant, it pays to install one of the range of A.E.I. motors.



An A.E.I. fractional horse power stator and rotor unit sealed into a Lec Refrigeration Ltd. refrigerator compressor.

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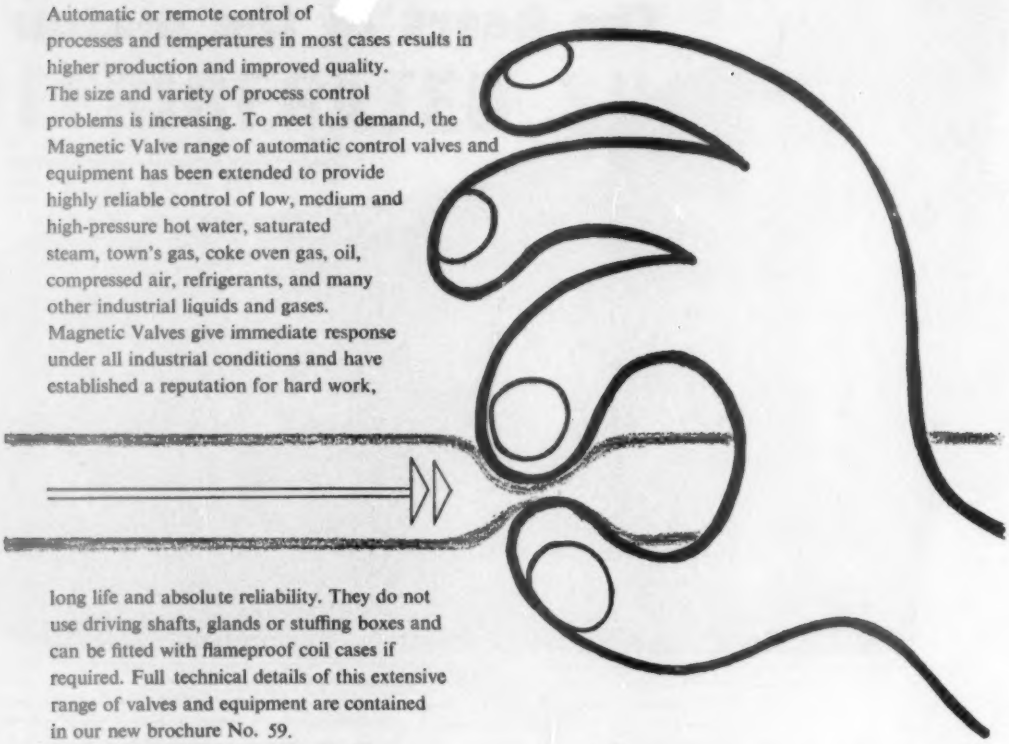

long life and absolute reliability. They do not use driving shafts, glands or stuffing boxes and can be fitted with flameproof coil cases if required. Full technical details of this extensive range of valves and equipment are contained in our new brochure No. 59. Why not write *NOW* for your copy?

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MV 3

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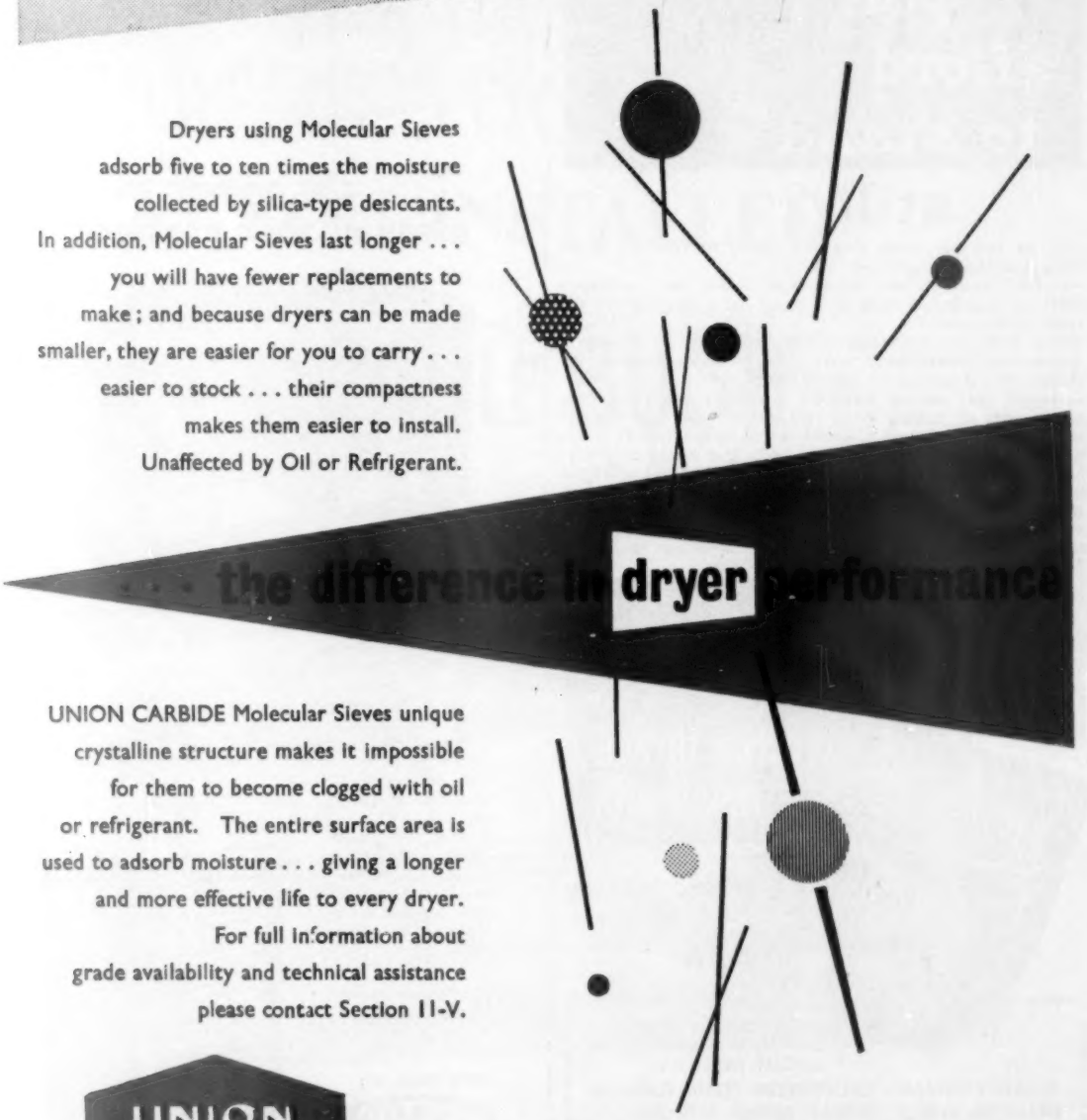

Dryers using Molecular Sieves adsorb five to ten times the moisture collected by silica-type desiccants. In addition, Molecular Sieves last longer . . . you will have fewer replacements to make; and because dryers can be made smaller, they are easier for you to carry . . . easier to stock . . . their compactness makes them easier to install. Unaffected by Oil or Refrigerant.

. . . the difference in dryer performance

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screw thread repair kits

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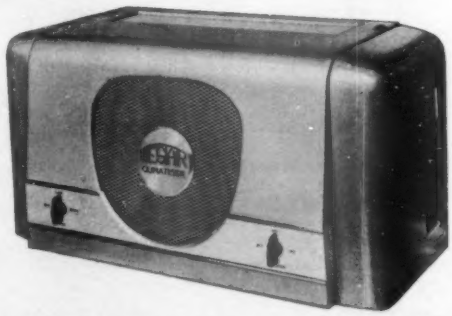
WESTAIR
room unit
AIR CONDITIONERS & DEHUMIDIFIERS

. . . the answer to many of your problems



'Westair' room unit air conditioners provide full scale air conditioning plus two important advantages. First, the number of units that can be installed is infinitely variable, which means that cost can be closely controlled. Secondly, 'Westair' units provide individual room control. Above is the ½ ton model which handles room capacities of up to 2,000 cu.ft.

Where the problem is humidity, dampness, or condensation the answer is the 'Westair' portable unit dehumidifier (below). It extracts moisture from the air quietly and efficiently and is ideal for stores, vaults, basements, drying out of new buildings, etc. Send **now** for full information on these units.

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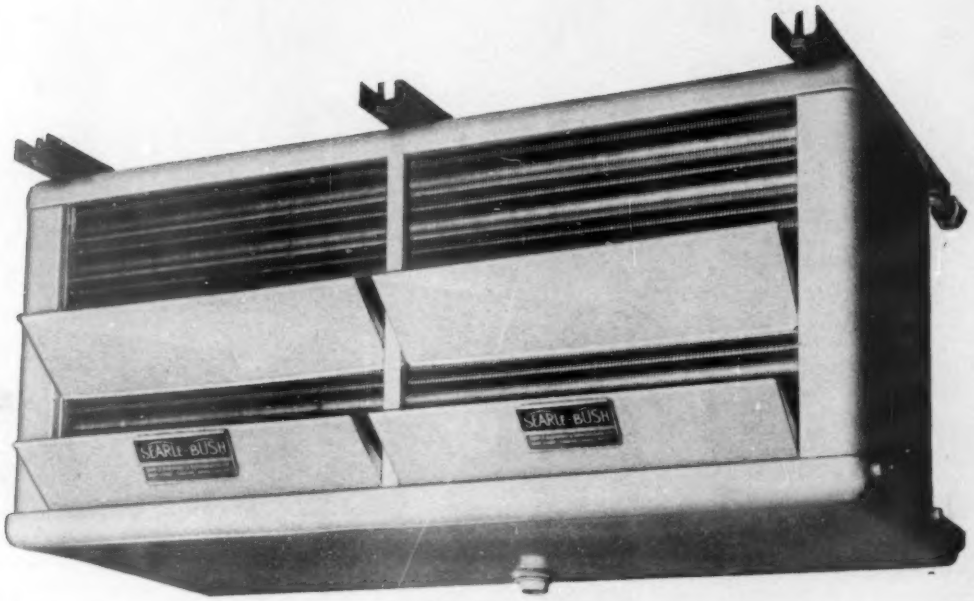
1959

WHAT A SUMMER!!

AREN'T YOU PLEASED

YOU INSTALLED

SEARLE BUSH



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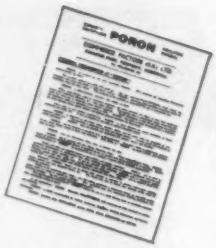

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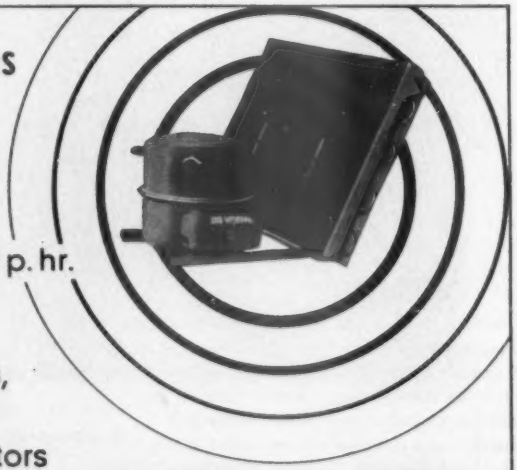

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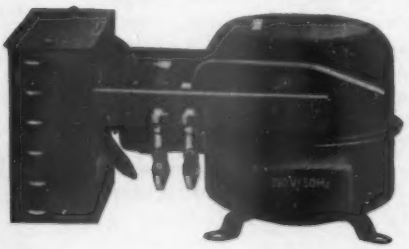

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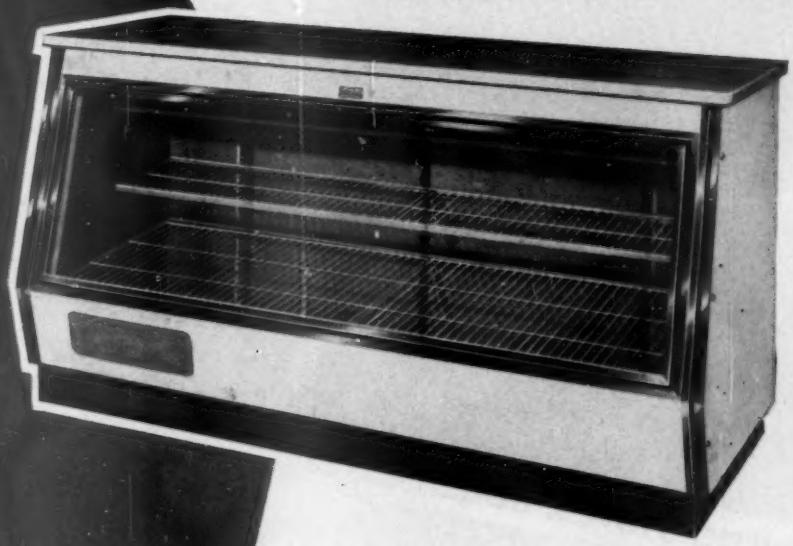

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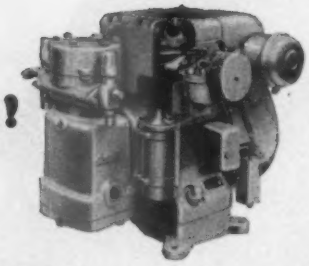

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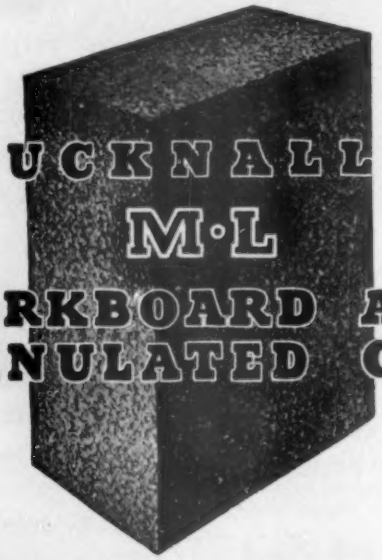

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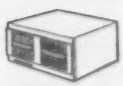

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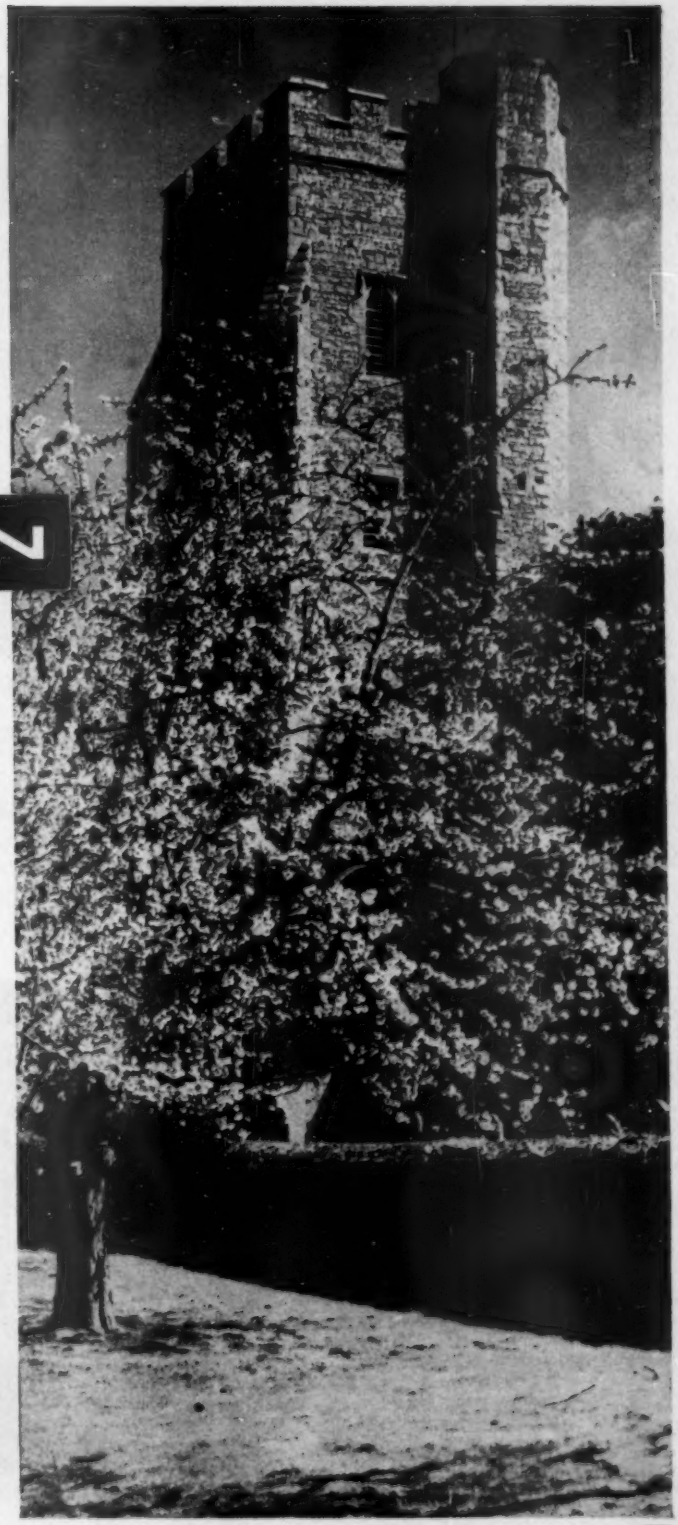

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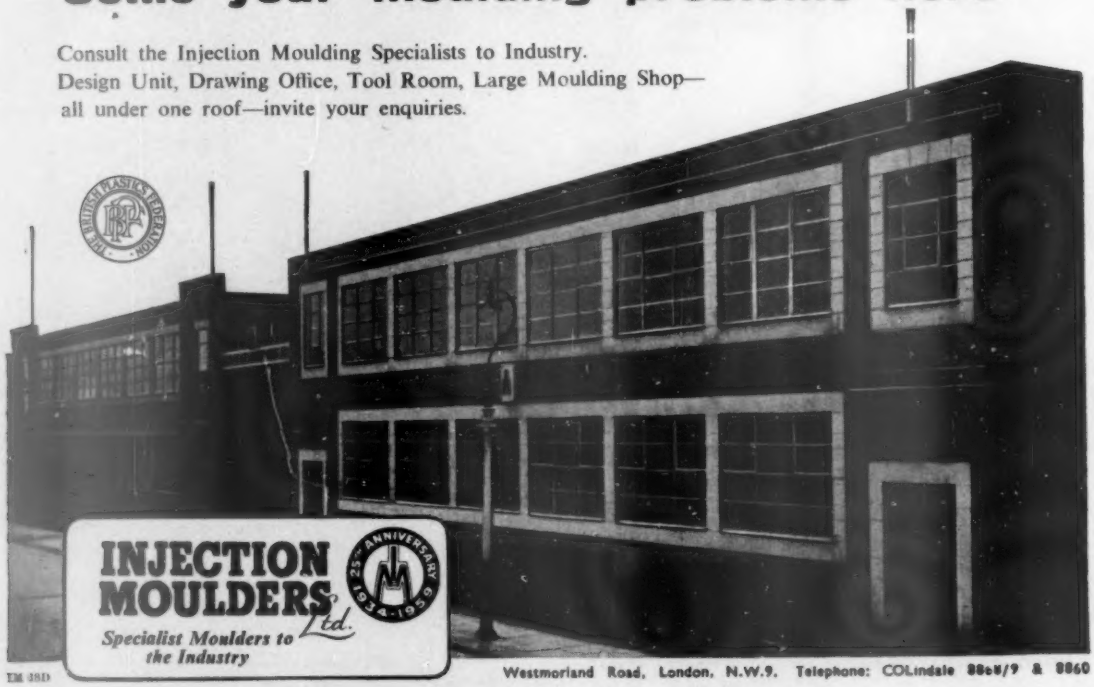

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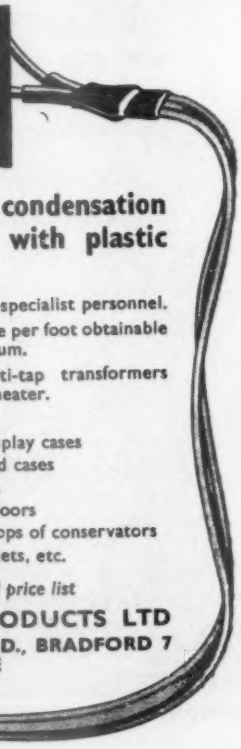

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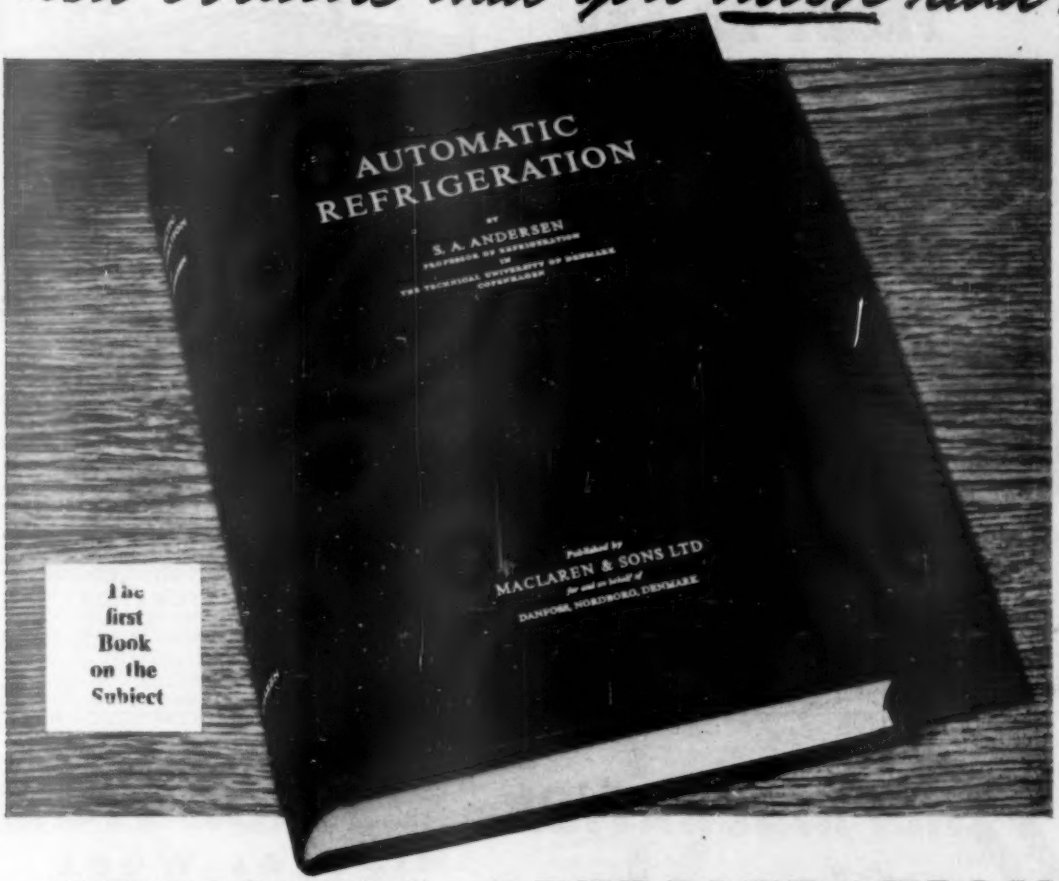

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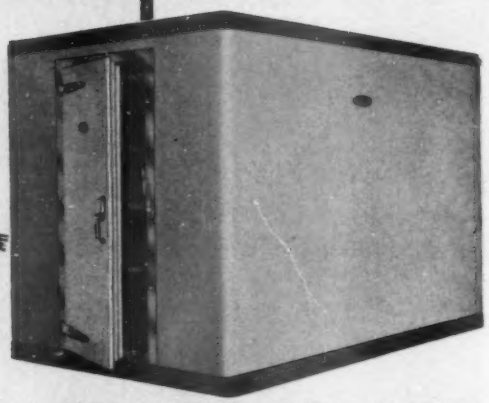

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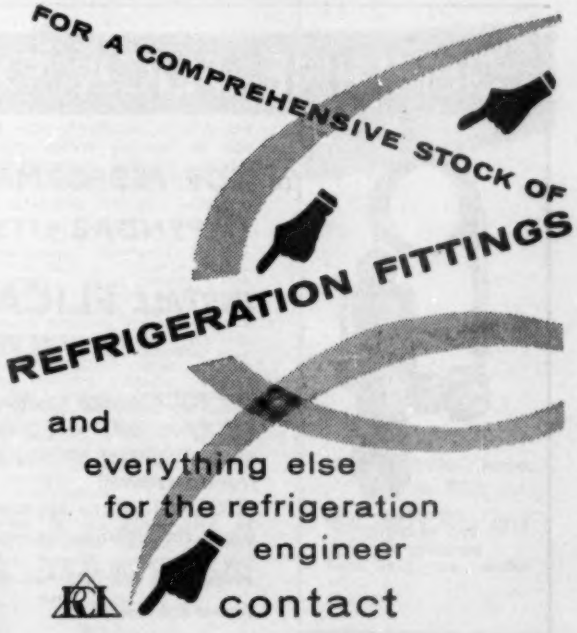

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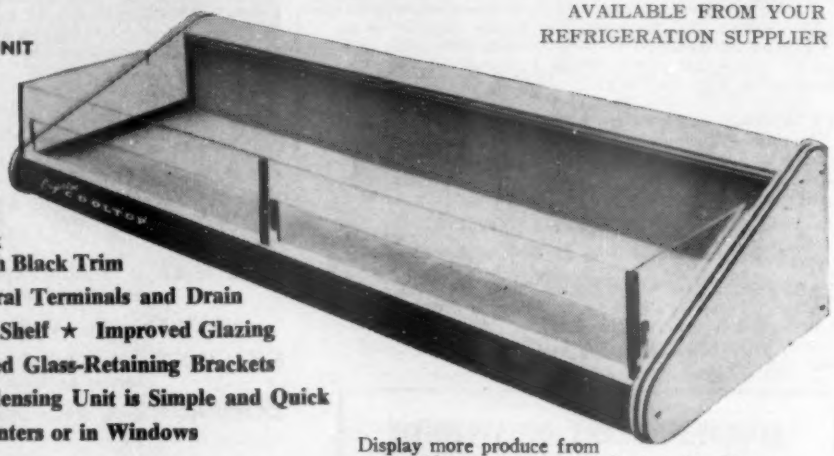

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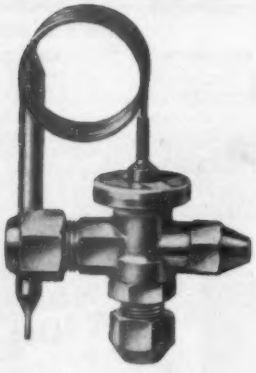

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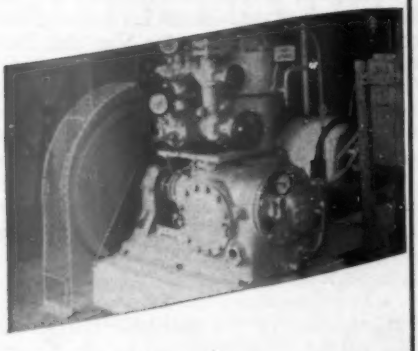

Editor-in-Chief:
THEODORE A. RAYMOND

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MODERN REFRIGERATION *overseas*

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VOLUME 62 NUMBER 740

November, 1959

Editorial . . . .

U.S. Q.-F.F. Experience

That 0° F. Ideal

British Trade Fairs

● If there is one advantage to be gained from lying second for most of the distance in a race it is that one can profit from the mistakes of the man in front. Undoubtedly, the United States had a clear start on all countries in the frozen food field and their experience has been of inestimable value to the later entrants. The present difficulties facing the industry across the Atlantic must be studied closely by members of the U.K. trade if the pitfalls are to be avoided.

● Briefly, two major problems are currently being experienced, your editor learned when attending the annual convention of the National Frozen Food Distributors' Association in Chicago last month. The first is the domestic one of "private labels." In short, packers have been so concerned with high volume output that they have processed vast quantities for the chain stores under the latter's own brand names and the point has now been reached when this output represents 79 per cent. of the business. The inevitable result is that the chain store is in a dominating position and the future for certain packers is very uncertain.

● The second problem more closely concerns the U.K. industry and it is the seeming inability of several sections of the trade, comprising the "cold chain," to provide a 0° F. temperature for the handling of these foods, this temperature having been deemed necessary for the maintenance of quality. It would appear that these foods in the States do not leave the packing plant at 0° F., are not transported nor stored at 0° F., nor are they retailed at this temperature. Some alarming figures were cited during the convention sessions. G. V. Hooning, past-president of the National Association of Retail Grocers, declared: "We began a check of frozen foods coming into the store and really had a shock. On Wednesday we get a small shipment on the regular grocery truck. They have two or three large insulated chests, holding about 35 cartons of mechandise each. The first time we checked a shipment, the temperature in the chests (August 12) was plus 38 in one and plus 42 in the other. We were told the chests were rolled into the big freezers at night, loaded there, then dry ice placed in them, and then rolled into the grocery delivery truck against the wall, with all grocery delivery packed around them. This was supposed to hold the cold! In the four-week test, and with the co-operation of the frozen foods supervisor from our warehouse the last two weeks, the best we have ever been able to record was a plus 32, a plus 19 and a plus 28 in those holding boxes. On Friday mornings we receive the larger shipment of frozen foods in the so-called frozen foods trucks. The lowest temperatures we have been able to get in the refrigeration-equipped trucks were plus 18 all the way up to plus 34." This gentleman's experience with his modern display cases was just as depressing.

● With the vast expansion now taking place in Q.-F.F. in this country, it cannot be stressed too often that quality considerations *must come first*. Refrigerated cabinets must be tested and tested again to ensure that they are equal to the job in hand. As the retiring president of the N.F.F.D.A., Tom Kirk, put it: "We have sinned most grievously in forgetting the first commandment of food marketing: 'Thou shalt not ignore those who eat your products'."

● If the foregoing has pointed to the blacker side of the U.S. industry, it should be added that there is also great optimism to be found there. For instance, it is forecast that supermarkets in 1969 will have literally miles of refrigerated shelves protected only by a thin curtain of air through which customers can easily reach for frozen food packages. This was the newest merchandising gimmick predicted by John B. Fowler, Jr., prominent national food man, in a luncheon speech to the National Prepared Frozen Food Processors Association at the Sherman Hotel. Mr. Fowler is chairman of Seabrook Farms Co., one of that nation's largest frozen food processors, and Seeman Brothers, a big east coast food distributor. By 1969, he predicted, the United States food industry will be producing over four billion packages of prepared frozen foods annually—three times to-day's total—and enough to reach more than halfway to the moon. He estimated the annual (U.S.) retail sales of all frozen foods will hit $5 billion —twice to-day's total.

● That the leaders of the domestic refrigeration industry are paying close attention to the progress being made in semi-conductors and their use in refrigeration was to be seen last month in a statement made by the director of Birmingham Sound Reproducers Ltd. to shareholders: "Fresh developments in the field of semi-conductors make possible ultimate obsolescence of existing refrigeration techniques and plant." Five months ago the company announced its plans to build a 360,000-square-feet factory at Old Hill for the mass-production of compressor units. It was designed to be one of the largest plants in Europe for this work. A company spokesman has said that negotiations for the building of the factory were still taking place with the Board of Trade.

● The whole machinery for the running of Britain's overseas trade fair has lately come under review and now should be better equipped to meet foreign competition. Arrangements have recently been concluded to broaden the base of British Overseas Fairs Limited in order to equip it for the increasingly important task of organizing British Trade Fairs overseas. The British Exhibition in New York next June will be the biggest and most important display of British industry's consumer and engineering products ever to be shown overseas. Further projects for later years in other parts of the world are under consideration.

● In view of this constantly expanding role of trade fairs in the service of British exports, the following arrangements, which have been approved by the Board of Trade, are announced: In order to provide for harmonious working between the national organizations concerned with trade and industry in all matters affecting British Trade Fairs overseas, the presidents of the Association of British Chambers of Commerce and of the National Union of Manufacturers, Mr. Frank Bower, C.B.E., and Mr. M. D. Oliphant, M.B.E., T.D., respectively, have been elected to the board of British Overseas Fairs Limited (B.O.F.). The directors are now, therefore, as follows: Sir Norman Kipping, J.P. (chairman); Mr. Frank Bower, C.B.E.; Mr. W. P. N. Edwards, C.B.E. (managing director); Sir Leslie Gamage, M.C.; Lt.-Col. Lord Dudley Gordon, D.S.O.; Mr. M. D. Oliphant, M.B.E., T.D., and Mr. P. F. D. Tennant, C.M.G., O.B.E.

● One of the first abattoirs to be built by private enterprise under the Government's new slaughterhouse policy is being officially opened in Bedford on the 9th instant by Mr. J. B. Godber, M.P., joint parliamentary secretary to the Ministry of Agriculture and Food. This new abattoir has a large cold store and meat sales depot. It will enable the firm to meet increasing demands for wholesale and other services over a wide area. Its opening will terminate a known record of 125 years' continuous slaughtering at the firm's Harpur Street, Bedford, premises. The old slaughterhouse is required for the new bakery and sausage and cooked meat factory, and for the extension of the firm's main shop. This long experience, coupled with detailed planning and application of work study, has been used to the full in the erection of this new building. It will, for example, be possible to ensure a greater throughput in a modern compact layout while the roof section of the abattoir will provide the all important natural air circulation for the correct rate of cooling of carcases.

REFRIGERATION SERVICEMEN'S ASSOCIATION

THE annual general meeting of the Refrigeration Servicemen's Association opened with the introduction to members of their first president, Mr. J. A. Howie, whose speech contained the significant phrase, "that to-day we are not selling refrigerators but refrigeration." This implies that due to the increasing number of different applications using refrigeration, the field is rapidly expanding. The need for good installation and service engineers is obvious.

The healthy position of the Association after the first 12 months was shown when the chairman, Cdr. Ranken, presented the annual report. Previously sent out to members, the report described the progress made both in membership, home and overseas, finance, the need for education facilities and the committee's steps in this matter. A description of last session's lectures, coupled with thanks to the lecturers who in many cases were called upon at short notice, was followed by the renomination of the committee.

A member from Northern Rhodesia, B. C. Hardey, was named as the winner of the badge competition and of the prize, a hand tool kit. While they were not as fortunate, Messrs. A. Marden, Walsham, L. J. Collett, Yarmouth, and R. J. Wood, London, N.W.2, were the remainder on the short list for final selection of a competition that proved the interest of members in their Association.

The lecture on a subject of never failing interest, "Expansion valves," was given by Mr. T. A. Clibbon. In comparing the performance of capillary tubes, "bleeder" and automatic expansion valves with the aid of slides, the advantages and disadvantages of each type were clearly shown. After discussing thermostatic expansion valves, intervention of time brought this interesting lecture to a close. This was unfortunate as no questions could be asked on this absorbing subject.

London Airport, the venue of our first tour, was visited on October 3, and although the numbers were disappointingly low, an interesting time was spent in visiting the lockers and cold stores in the B.O.A.C. kitchens where both raw and prepared produce is stored. Also the prepared meals on trays ready for service on the 'planes. For long-term storage, a shock freezer is used to freeze the produce to $-20°F$. before storage for subsequent usage. Blower units are in use in most rooms with hot gas defrosting in the deep-freeze rooms and water defrost in the remainder. Also seen in the kitchens were two ice-block makers. Situated under the kitchens was the compressor room which was included in the visit.

Following a tour of the maintenance and workshops where propellers, various types of engines and electrical equipment were seen in the process of repair, a Britannia aircraft in for the major overhaul was visited. In the small kitchen could be seen two hermetic-powered refrigerated cabinets.

Returning to the coach, members passed Comets and other planes including a Britannia in a static dock. This dock is an ingenious device that comprises a series of stages built round and up the aircraft to enable repairs to be carried out at the required levels. Returning to the starting point, tea was served before leaving for London after an enjoyable tour.

All members and visitors are reminded that the meetings this winter are held in the lecture hall of Messrs. Danfoss Mfg. Co., 71, Queensway, London, W.1, the last Wednesday of each month at 7.30 p.m.

NEWS OF THE MONTH

Refrigeration and A-c. Exports.—During September 1959, air-conditioning and refrigerating machinery (commercial and industrial sizes) to the value of £696,019 weighing 1,017 tons, was exported from the United Kingdom. Comparable figures for September 1958 were 917 tons, worth £555,124.

* * *

Exports' Analysis.—Of the 1,017 tons of air-conditioning and refrigerating plant worth £696,019 exported by Great Britain in September—quoted in the preceding paragraph—60 tons went to the Union of South Africa, 114 tons to India, 75 tons to Australia, 40 tons to New Zealand, 22 tons to Canada, 204 tons to " other Commonwealth countries," 24 tons to Eire, 15 tons to Sweden, 136 tons to Western Germany, 33 tons to the Netherlands, 20 tons to Belgium, 7 tons to France, 66 tons to Italy, and 201 tons to " other foreign countries."

* * *

Refrigeration Plant Classified.—Of the total exports of air-conditioning and refrigerating machinery during September, quoted in the first paragraph, commercial refrigerators accounted for 224 tons, worth £123,570, industrial plant and equipment for 166 tons worth £86,376, refrigerating equipment and parts, including parts of commercial refrigerators, for 283 tons, worth £245,423.

* * *

Exports of Small Refrigerators.—During September, 581 tons of complete refrigerators and domestic refrigeration equipment were sent overseas from Great Britain. These exports were worth £372,115. The 581 tons comprised 15 tons to the Union of South Africa, 15 tons to Rhodesia and Nyasaland, 9 tons to India, 49 tons to New Zealand, 288 tons to " other Commonwealth countries and Irish Republic, 17 tons to Sweden, 6 tons to Western Germany, 3 tons to the Netherlands, 12 tons to Belgium, 2 tons to Italy, and 165 tons to " other foreign countries."

* * *

DoRDeC Officers.—At the annual general meeting of the Domestic Refrigeration Development Committee (DoRDeC) Mr. E. G. Rowledge, Pressed Steel Co. Ltd., was re-elected chairman. Mr. M. A. Craig, Electrolux Ltd., was re-elected vice-chairman. The secretary of DoRDeC is Mr. Claude Simmonds, C.S. Services Ltd. R. & A. Main Ltd. have been elected to membership of the Domestic Refrigeration Development Committee. There are now 10 members of DoRDeC, which is representative of the leading domestic refrigerator manufacturers in this country and is responsible for the public relations and promotion of the domestic refrigeration industry.

* * *

Engineering Exhibition, Sydney.—The annual Engineering Exhibition will be held at the Sydney Showground from July 18 to 23, 1960. The Manufacturers' Hall, Hordern Pavilion, Commemorative Pavilion and the Arts and Crafts Building will be used to house the exhibits. The cost of space in Australian currency is : 100 sq. ft., 15s. per sq. ft. ; 200 sq. ft., 14s. ; 300 sq. ft., 13s. ; 400 sq. ft., 12s. ; over 400 and under 500 sq. ft., 11s. ; 500 sq. ft. and over, 10s. The Engineering Exhibition alternates between Sydney and Melbourne where it will be held in 1961. Brochures are not issued as space is rebooked immediately after the event closes and 90 per cent. of the space has already been booked for the 1960 event. It may therefore be too late for would-be United Kingdom participants to book space but United Kingdom business men in

A recently produced example of Mann Egerton's standard 25 ft. refrigerated semi-trailer.

Sydney during the Engineering Exhibition might consider visiting it with a view to asking their agents to consider participating at the 1961 Melbourne event or the 1962 Sydney event. United Kingdom firms who are interested in the Engineering Exhibition should communicate with Industrial Public Relations Service (N.S.W.) Pty. Ltd., Box 4962 G.P.O., Sydney, N.S.W.

* * *

The Simon Memorial Prize.—To commemorate the late Sir Francis Simon, C.B.E., F.R.S., who was Dr. Lee's Professor of Experimental Philosophy and head of the Clarendon Laboratory, Oxford, the Low Temperature Group of the Physical Society has instituted a Simon Memorial Prize. This is an award to the value of £250 which is to be made at about three-yearly intervals for distinguished work in experimental or theoretical physics. The award has been made possible by the generous support of organizations and individuals who responded to an appeal made by the Low Temperature Group, in the formation of which in 1946 Sir Francis Simon had taken a leading part.

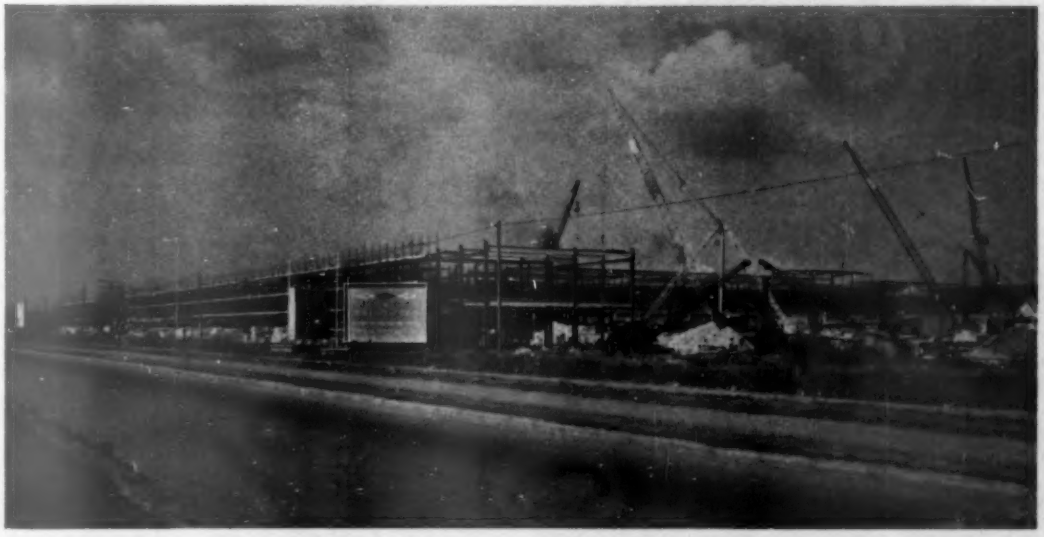
To Dr. Heinz London, of the Atomic Energy Establishment, Harwell, has come the distinction of being the first recipient of this award. The presentation was made by Dr. P. H. Sykes, the chairman of the Low Temperature Group at a meeting held at the Royal Institution, London, on Tuesday, October 13. Lady Simon and many friends and fellow-workers of Sir Francis were present at this the opening meeting of the Low Temperature Group for the 1959–60 Session. Following the award, Dr. London delivered the first Simon Memorial Lecture. He chose to speak on "Superfluid helium," and in presenting a comprehensive survey of the remarkable properties of this liquid and the theories which have been proposed for explanation, Dr. London, to quote the chairman's concluding remarks, "set a high standard for the future."

* * *

Refrigeration for Turkeys.—The urgent need for reviewing the freezing and refrigeration facilities available in the turkey industry was stressed at the first Scottish conference of the British Turkey Federation held in Gleneagles in October. Giving figures of development, the B.T.F. chairman, Mr. A. W. Motley, said that in 1914 there were 500,000 turkeys in Britain; by 1939 there were 700,000; in 1956 the numbers rose to 1,750,000, and by Christmas of this year the turkey population would be 3,500,000, with an additional million imported birds. He expected the British population to double again to 7,000,000 by 1964.

PICTURE *of the Month*

Six months ago, this was a bare and windswept site; now, this new factory, being built by the Board of Trade for the Prestcold Division of the Pressed Steel Company at Crymlyn Burrows, Swansea, is already within six months of production. Ultimately, it will employ between 3,000 and 4,000 people.



The Cold Store Operator *and* The Frozen Food Packer

At the annual luncheon of The National Federation of Cold Storage and Ice Trades, briefly referred to in our October issue, chief guests were Sir Henry S. Turner and Mr. J. R. Parratt. As chairman of the Birds Eye organization in Britain, Mr. Parratt, in his speech, questioned whether the cold storage industry was playing as full a role as it might in meeting the needs of the frozen foods trade. Mr. Eugene Ruddin, C.B.E., president, had already championed his members.

"THE recent International Congress of Refrigeration, which was held in Copenhagen, more than underlined the excellent relationship and good feeling that existed not only between members of the industry in this country but between—and this is more importantly so—the 40-odd nations that participated," declared Mr. Ruddin, "and it proved once again that if the ordinary men in the street, irrespective of

Mr. Eugene Ruddin, C.B.E.

nationality, could get together, talk to, and know each other better, then the outlook of the world would be very much healthier and happier, because the substance of wealth is the relationship and attitude towards each other.

"The papers discussed at the congress showed a constant progress in refrigeration technique, but it was apparent that particular emphasis is being placed, at the present time, on the development of quick-frozen foods. At the moment, in Britain, quick-frozen foods represent just under 1 per cent. of the total food sales, while in the United States this is about 4 per cent., and in a small country like Sweden

"A COUNTRY squire once sent his estate workers a barrel of beer so that they could celebrate his birthday. The following day he asked his head gamekeeper how they had enjoyed it. 'Middling sir, middling,' he said. 'What d'ye mean by middling?' said the squire. 'Well sir, it was like this. If it had been any better you wouldn't have sent it, and if it had been any worse we wouldn't have drunk it.' Well, gentlemen, I am sure my fellow guests will agree with me that on this occasion we could not have been treated to greater hospitality or better food", declared Mr. Parratt.

"Now I feel I ought to use this opportunity to say a few words about quick-frozen food, because it has

Mr. J. R. Parratt.

already become of great importance to all of you in the cold storage industry. Five years ago, my company placed before a number of leading members in your industry a five-year plan of development which showed that zero cold storage capacity would have

MR. EUGENE RUDDIN

about 2 per cent., but it is quite clear that the demand for zero and sub-zero storage space is gaining impetus. It is therefore our members' responsibility to see that they make themselves thoroughly acquainted with the facilities and services required, and as far as this Federation is concerned, we are at all times ready to help, I am quite sure, and to examine matters collectively if called upon to do so.

" The demand for general cold storage has been maintained reasonably well throughout the year, although in the last few months interest has slackened in a few areas. It is, however, hoped and believed that this is of a temporary nature.

" In regard to the Government cold stores, it is common knowledge that a few months ago the Government informed the industry and the company of management—that is the company of management that is sponsored and controlled by the Ministry, in co-operation with the industry, for taking care of these stores—that it intended to offer for sale to the industry selected stores, and without my going into great detail, three stores have in fact been sold.

" The problem, of course, still exists. What is the Government going to do with the remaining stores, and there are 44 ? At present they are adequately taken care of, and in a most efficient manner, by the industry in association with the Government, and what better arrangement could there be for assisting the Government to observe its pledges ? It is a factual and simple solution to a complex problem, and might I add, we never at any time willingly agreed with the Government that any stores should be offered for sale, particularly in view of the existence of the managing company, and it was in our view a very short-sighted policy, with which we in this Federation do not agree, and I think this is an appropriate time in which to make this point clear.

" We were also told that the ' powers that be ' wished to consult with us about the remaining stores and the question of the pledges that had been given to the industry, but of course the General Election has postponed discussions. Nevertheless, we expect Governments, having made pledges to the industry, to undertake them without question or prevarication. People in business are held to be men of their word, and we see no reason to exclude Governments.

" Furthermore, when the Government does approach us later it should be prepared to discuss and examine jointly with us, and not arrive with a predetermined policy to be forced upon an industry—regardless of that industry's opinions. I regret to say that is really what has happened. We are—and I wish to assure the Government—willing to co-operate in every way possible, but in order that this should be done it is certain that mutual confidence must exist.

" The other matter of moment which comes to mind is that of the application by a vast majority, one might say 99 per cent., of the London Dock Cold Stores who wished to contract out of the Dock Workers

(*continued overleaf*)

MR. J. R. PARRATT

to be increased to cope with the future expansion of Birds Eye alone, apart from the many other processors in this field. I remember then how difficult it was to convince some people of the tremendous growth prospects of quick-frozen food ; and if it had not been for the faith of some of you, particularly Mr. Jaeger, who often kindly acted as a sort of interpreter between ourselves and your industry, there would have been a serious shortage of suitable storage space.

" In those five years the sales of retail packs of quick-frozen foods in this country have risen from some £4,750,000 sterling to around £36,000,000 this year. That is an expansion of some seven and a half times in five years. In the face of such figures one might well expect a severe tailing off. Certainly one cannot expect the same percentage rate of expansion to continue, but in view of the tremendous advantages that quick-frozen foods offer to the British housewife, I can see no reason to suppose that there will be anything other than continued rapid expansion for many years to come.

" Development of the market has really only just begun. In vegetables, fruits, fish, poultry, meat, flour confectionery and prepared meals, quick-freezing is already playing its part, but in my opinion it has so far only scratched the surface in these fields.

" When you consider that in the United States of America quick-frozen foods represent over 4 per cent. of the total food sales, whereas in this country we have only reached $\frac{3}{4}$ of 1 per cent., you will have a clearer idea of the fantastic prospects that lie ahead.

" Some 12$\frac{1}{2}$ years ago my predecessor, George Muddiman, addressed you, and I believe caused quite a sensation by telling you of the prospects of quick-frozen foods and of the fundamental changes in thinking which the cold storage industry would have to undertake. Well, I have told you what I think of the prospects, but I am afraid that when it comes to the question of the changes which the cold storage industry must make, they vary little from what my predecessor said 12 years ago. It is a fact that during the past five years many processors have themselves built large stores well in excess of what is needed as basic factory stores. Now I can assure you that processors don't want to put money into cold storage and they only do so when it pays hand over fist.

" The reason why it pays so well is that the rates for cold storage of quick-frozen foods in this country are, so far as I am aware, higher than in any other country in the world where quick-freezing has been substantially developed—the rates in London are twice those of New York and almost twice those of Stockholm. Whether these high rates are due to an incorrect allocation of costs as between quick-frozen foods and the many other items that you store, whether they are due to out-of-date stores or handling methods, or whether too much profit is being taken, is not for me to say. I do know, however, from our own experience, just how cheaply large modern cold stores can be built and how cheaply and easily quick-

(*continued overleaf*)

MR. EUGENE RUDDIN

(Regulation of Employment) Act, 1946. The reason why they have been placed in this position would seem to be because the Ministry of Food were using part of those premises for storage purposes during and at the end of the war—the point being the desire to conserve labour—and whilst no one would argue that a casual system of employment is one to which we should return, it is false in its concept and it is morally wrong, it does seem most unusual to find firms being forced to contribute to a scheme designed to remove casual labour when they themselves appear to be willing to offer full-time employment or regular employment."

* * *

MR. J. R. PARRATT

frozen foods, in their neat little cases, can be handled. Thus, given the right sort of store and the right methods, I can say with certainty that rates for storing quick-frozen foods could be slashed and a fair profit still made.

" I would ask you to consider for a moment the position of the British processor to-day. Facing increasing competition from the Continent and from North America, he has to pay cold storage rates grea'y in excess of those that his competitors enjoy. Inevitably, the result will be increasing imports of products which have already been stored for some length of time elsewhere and which are for immediate sale in this country. Not only will the British processor suffer, but you, gentlemen, will be allowing the foreigner to increase his cold storage revenue at your expense.

" All this adds up to the need for the cold storage industry to study the techniques of modern cold-store construction and operation and then to decide to what extent it would be profitable to house the lion's share of the future expansion of the quick-frozen food industry. I am glad to say that one or two members in the industry have taken steps in this direction, but they are at present just drops in the ocean when looked at against the future expansion of quick-freezing.

" Perhaps, gentlemen, I have been rather blunt, but the ball is at your feet and I would be failing in my duty as your guest if I did not frankly state my views of the prospects of my industry and of the way in which you can participate in our progress.

" There was once a parrot—though perhaps to avoid confusion I should say a cockatoo—whose owner decided it was lonely. So he bought another parrot and put it in the cage with the first one. In the morning he found the new parrot mutilated and dead on the floor of the cage. So the next night he put a toucan in with the parrot. The following morning he found the toucan dead. So he thought he would teach the parrot a lesson and that night he put a vulture in with it. In the morning he found the vulture dead in one corner of the cage and the parrot, stripped of its feathers, in the other corner. ' Blimey,' said the parrot, ' I had to take my coat off to that one.'

" Well, gentlemen, I feel you have to take off your coats to this one, too," concluded Mr. Parratt.

THERMOELECTRIC REFRIGERATION

An Old Hill, Staffordshire, company **Birmingham Sound Reproducers Ltd.**, have announced that their plans for the mass production of compressor units for refrigerators are now to be deferred. " Fresh developments in the field of semi-conductors make possible ultimate obsolescence of existing refrigeration techniques and plant." The directors of the company stated in a message to their shareholders on Thursday, October 22. Five months ago the company announced their plans to build a 300,060 sq. ft., factory at Old Hill for the mass production of compressor units. The factory was designed to be one of the largest plants in Europe for this work. A company spokesman also said that negotiations for the opening of the factory were still taking place with the Board of Trade. " Our present factories in Old Hill and Northern Ireland are fully occupied," he said " in the manufacture of equipment for record changers and tape recorders." The spokesman added that he could not at this time disclose the company's future plans for the proposed factory, but we understand that the present negotiations are over the siting of the new factory. The Board of Trade is operating a tougher policy in issuing permits for factories to be built in the Midlands region, and is urging companies who wish to expand to build their new factories in such development areas as South Wales, Northern Ireland, parts of Devon and Cornwall and Anglesey. In their statement to shareholders the board of directors made no reference to the new factory whatsoever. Announcing the payment of an unchanged 15 per cent. interim dividend the directors say the sales of record changers are now at record levels, and the new " Tape Deck " is now contributing substantially to their profits.

N.F.C.S.I.T. LUNCHEON—1. The president, Mr. Eugene Ruddin, C.B.E., left, receives the guests; 2. Sir Henry S. E. Turner and Mr. Kenneth Lightfoot, O.B.E.; Mr H. G. Jaeger, Mr. J. Semple and Mr. W. M. Pooley; 4. Mr. R. H. R. Lloyd, Mr. P. S. Henman and Mr. R. G. Bundey; 5. Mr. G. T. Gear, E. Hall, Col. H. Randal Steward and Mr. J. R. Parratt; 6. Mr. H. Boyd, Col. L. D. Bennett and Mr. P. K. Edwardes-Ker; 7. Mr. W. A. P. Milne, M.B.E., Mr. R. Finlay and Mr. A. D. Hillhouse, O.B.E.; 8. Mr. F. J. Anthony, Mr. A. E. Kittle, Dr, R. Earle, Mr. W. Syme, Mr. J. Douglas and Mr. R. C. Joscelyne; 9. Mr. J. J. Paige, Mr. E. A. Tappenden, Mr. R. A. Barrell, Mr. M. Costa, M.B.E., and Mr. F. H. Hunt; 10. Mr. A. M. Dodds, Mr. G. A. May, O.B.E., and Mr. J. Mackenzie

National Federation of Cold Storage and Ice Trades

Annual Luncheon

(names opposite) *"M.R." Photorecord.*

AMMONIA LIQUID PUMP RECIRCULATION SYSTEMS

By W. B. SCOTLAND

For some mysterious reason the few refrigeration technical and data books which mention liquid pump recirculation systems only do so in a very general manner. This system has been in use for over 30 years and the advantages have long been established in practice. Those fortunate owners and operating engineers who have had conversions carried out, on the older type manually operated direct expansion systems, will be the first to confirm this fact. They are in a more favourable position to realise the possible increase in efficiency than users who have had liquid recirculation systems incorporated in completely new installations.

Introduction

IT is the purpose of this article to study what takes place within a liquid pump recirculation system and to provide some data and guidance for those who, from time to time, become involved in the design and application of this type of system. The information given hereunder is based on conservative engineering practice and we do not deny that short-cuts can be made ; however, the tools are provided in this article to put a liquid pump recirculation system to work in the best prescribed manner.

Fig. 1 indicates a flow diagram for a liquid pump recirculation system; on this are indicated pressures, temperatures also quantities of liquid and vapour in circulation, at various points in the system. The figures are calculated on the basis of an ideal cycle, heat gains to the interconnecting piping, accumulator, etc., not being taken into consideration. Line pressure drops are also not taken into account. These factors should not be overlooked on actual applications.

The information is given hereafter in the form of questions and answers.

Q. What are the advantages of liquid pump recirculation ?

A. The main ones are as follows :—

(1) As a result of having a completely wetted surface, also good turbulence, in the evaporators high film coefficients are achieved resulting in efficient operation.

(2) It is possible to obtain the advantage of flooded operation in relatively long overhead and wall pipe coil systems which could not normally be achieved by natural gravity flooded operation due to the lengthy circuits and the accompanying high pressure drops.

(3) Hot gas defrosting is conveniently arranged as the liquid, resulting from the condensing of the hot gas, can be circuited into the accumulator with little difficulty and without risking the return of liquid slugs into the compressors. The problem usually associated with hot gas defrost arrangements is that this condensate has to be re-evaporated by an external heat source, or transferred to the high pressure side of the system by pumps or other means; alternatively it can be contained during defrost cycle in special liquid pressure vessels or surge vessels. This problem is by-passed as, provided that the liquid recirculating system is correctly designed, the return of the condensate to the accumulator will not affect the operation of other circuits.

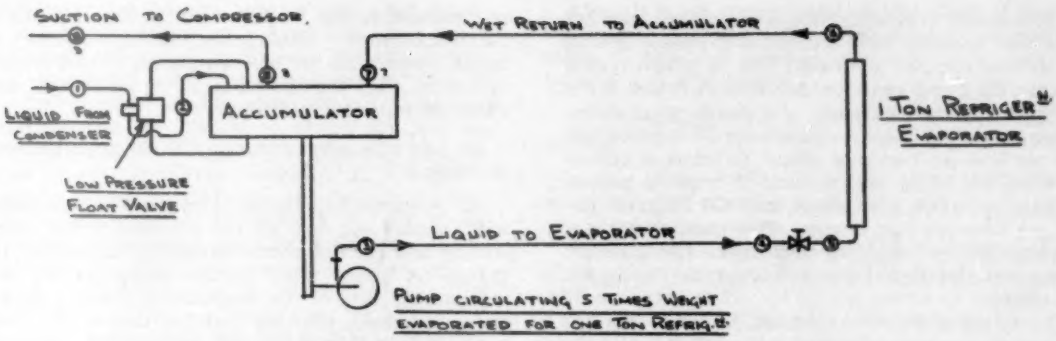
(4) The accumulator and pumps are usually located within the engine room under the eye of the operators. If a number of circuits or rooms are connected to the system these would otherwise have to have individual surge vessels and controls to achieve flooded operation.

(5) The separation and drainage of excess oil is simplified by comparison with other systems. The oil is washed out of the evaporators into the accumulator from where it can be drained.

(6) In view of the fact that the suction gas entering the compressor is drawn directly from the accumulator it will not contain any unevaporated liquid and will be dry with little superheat resulting in the most satisfactory operating conditions for the compressors.

(7) No adjustment of regulators is required. The liquid will be fed to the evaporators at approximately the same pressure at all times irrespective of the condensing pressures which are subject to seasonal and other variable factors.

Q. What type of pump can be used for ammonia systems ?


SUCTION TO COMPRESSOR.
WET RETURN TO ACCUMULATOR
LIQUID FROM CONDENSER
ACCUMULATOR
1 TON REFRIGN. EVAPORATOR
LOW PRESSURE FLOAT VALVE
LIQUID TO EVAPORATOR
PUMP CIRCULATING 5 TIMES WEIGHT EVAPORATED FOR ONE TON REFRIG.N

Location Number	Ammonia Temperature Degrees F.	Ammonia Pressure P.S.I.G.	Weight of Liquid per Minute. Lbs.	Weight of Vapour per Minute. Lbs	Volume of Liquid per Minute. Cu.Ft.	Volume of Vapour per Minute. Cu.Ft.	Ratio of Weight. Liquid to Vapour	Ratio of Volume. Vapour to Liquid.
1	86	134.5	0·4216	0	0·01134	0	–	–
2	5	19·6	0·3539	0·0677	0·00861	0·8518	5·227	6·416
3	5	29·6	2·1080	0	0·0513	0	–	–
4	5	29·6	2·1080	0	0·0513	0	–	–
5	5	19·6	2·1080	0	0·05127	0	–	–
6	5	19·6	1·7541	0·3539	0·04267	2·885	4·956	67·63
7	5	19·6	1·7541	0·3539	0·04267	2·885	4·956	67·63
8	5	19·6	0	0·4216	0	3·4368	–	–
9	5	19·6	0	0·4216	0	3·4368	–	–

FLOW DIAGRAM FOR BASIC LIQUID AMMONIA PUMP RECIRCULATION SYSTEM WITH TABLE INDICATING CONDITIONS AT VARIOUS POINTS FOR STEADY FLOW OPERATION

FIGURE 1.

A. Gear, concentric rotary, centrifugal, turbine vane and worm type pumps have all been used to circulate liquid ammonia. It has been found that some pumps which operate very successfully with ammonia on tank car transfer, oil refinery and similar high temperature duties do not perform satisfactorily when applied to refrigeration systems. The conditions under which recirculation pumps operate are particularly rigorous due to the following reasons :—

(*a*) Fluctuating pressures and temperatures have to be contended with (*b*) Liquid flashing and cavitation frequently take place due to fluctuating conditions and to improper application and installation (*c*) Lubrication difficulties can exist due to the low temperatures and fluctuating pressures (*d*) Solid matter such as welding slag, carbonized oil, and sludge found in old installations, can result in damaging abrasive action taking place.

It is recommended that a pump of a type which has been proven for this application should be used. Stuffing box type glands or double rotary seals only should be incorporated in the pumps. To date the standard mechanical seal has been troublesome except when a double seal arrangement, with oil in the space between the seals, is employed. Special lubricating devices should be installed to ensure positive oil feed to the gland without the possibility of overfeeding taking place.

An operating pump and a standby should preferably be installed unless replacements are readily available. Relatively slow speed pumps driven through vee belts or gears generally have a longer life than direct driven pumps of the high speed type.

Q. What quantity of liquid ammonia should be circulated ?

A. If it were possible to adjust the flow of liquid ammonia to each evaporator to suit exactly the load requirements, which is the basic problem with all regulating devices, we would only have to circulate sufficient ammonia to ensure slight overfeeding and completely wetted surfaces, so that about 125 per cent. of the quantity evaporated would serve the purpose for most duties. Because of the fact that such a regulating device is not available we err on the safe side and circulate approximately five times the quantity of liquid evaporated in the system. This ensures that excess ammonia, in liquid form, is circulated to all circuits. The flow can be adjusted by throttling valves (sometimes called balance valves or regulating valves). Hand expansion valves are employed for this purpose.

The quantity to be circulated is not critical; one has to be sure to pump sufficient liquid to ensure feeding to all the circuits involved. For a given system capacity the pump capacity should be increased as the number of circuits increase. To ensure good distribution we should figure on circulating 30 Imperial gallons per hour per 1-in. pipe circuit, 50 Imperial gallons per hour per 1¼-in. pipe circuit, 75 Imperial gallons per hour per 1½-in. pipe circuit and 100 Imperial gallons per hour per 2-in. circuit. It is usual to make a selection on the basis of five times the quantity evaporated and then to check this against the figures per circuit.

The weight of liquid evaporated per hour does not vary much per ton at different conditions, *e.g.* At –40° F. evaporating and 85° F. condensing temperatures the lbs. evaporated per hour are 26·16 compared with 25·26 for an evaporating temperature of +5° F. If we calculate the evaporation on the basis of gallons per hour we get 3·8 for –40° F. and 3·83 for +5° F. The small difference in the volume ratio is arrived at due to the different liquid densities at the respective evaporating temperatures. Therefore, based on the recommendation given above the quantity circulated per hour should be in the region of 19/20 Imperial gallons per ton refrigeration.

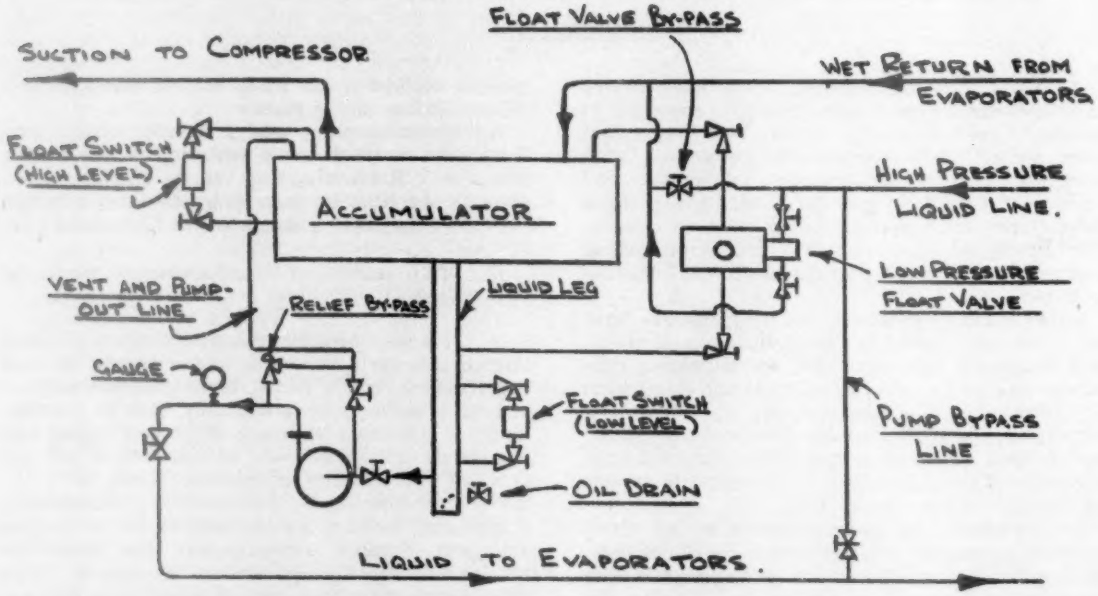
A point worth noting is that the flash gas, formed at the system regulating device, at the accumulator, and resulting from the drop in pressure and temperature, is separated at this vessel before the liquid passes to the evaporators. This means that the quantity of liquid evaporated per ton within the evaporators is in fact less than the figures, based on the refrigerating effect, as indicated previously.

Q. Against what pressure will the pump have to circulate ?

A. A pressure gauge fitted on the pump discharge will indicate the sum of the pressure at the pump suction and the differential operating pressure of the pump. A gauge fitted to the pump suction will indicate the sum of the evaporating pressure within the accumulator plus the pressure due to the static head of liquid in the liquid leg less the frictional pressure drop due to the flow of ammonia through the liquid leg and pump suction connexions.

The pump should be selected to circulate the liquid ammonia against the sum of the pressures due to the static head plus the frictional drip through the discharge connexions to the evaporator plus the pressure required at the throttling valve or orifices at the evaporators.

We should bear in mind the fact that hand expansion valves, which may be used as throttling valves, are designed to regulate the flow at the pressure differences existing between the condenser and evaporator on a conventional system. Also the quantity of refrigerant normally metered through



TYPICAL AMMONIA LIQUID PUMP AND ACCUMULATOR ARRANGEMENT

FIGURE 2.

these valves should only balance that evaporated. The size of the orifice on a hand expansion valve does not, therefore, necessarily bear any relationship to the size of the valve connexions and is, in most cases, considerably smaller than these. Therefore, we should size the throttling valves to suit the quantity circulated through the evaporators and the smaller pressure differences existing. It is usual to design the system to provide a pressure, at the inlet to the throttling valves, of about 10 lb. per sq. in. above the evaporating pressure. General recommendations for sizing the throttling valves are to use a ½-in. valve for up to 50 gallons per hour, ¾-in. for 50 to 150 gallons per hour, 1-in. for 150 to 250 gallons per hour, 1¼-in. for 250 to 400 gallons per hour and 1½-in. valve for 400 to 600 gallons per hour. Orifices, if used, must be sized for individual requirements.

With regard to the static lift, this will vary depending on the temperature and the corresponding density of the liquid. The latter does not vary to any degree over the normal temperature range and a figure of 3·5 ft. for each lb. increase in the pump pressure would be realistic.

With reference to the pressure drop in the pump discharge piping, this will vary depending on the pipe sizing, the quantity being circulated and the length of connexions, similar to any calculation for pressure drop in piping.

It is advisable to have a relief valve fitted to the pump discharge, especially in the case of positive feed type pumps so that, in the event of valves being closed on the delivery lines, the liquid will by-pass through the relief valve and return to the accumulator. Another important point to take into consideration is that in the event of a number of circuits on a system being closed off it is advisable not to increase the flow through the remaining circuits, if possible, as large pressure drops will be caused in them which may result in decreased efficiency in these circuits. By over-circulating it is possible to decrease the evaporator efficiency because the temperature difference at the inlet of the evaporator would be decreased below normal resulting in less heat transfer.

A common misconception of liquid pump recirculation systems is that ammonia is being circulated around the system in the liquid state in much the same way as water or brine would be pumped through pipe coils. This is, of course, not correct as the pump, or pumps, only feed the liquid ammonia to the throttling valves or orifices on the inlet to the evaporators. From the downstream side of these valves or orifices the fluid is drawn back to the accumulator by the compressor. The ratio of typical relative weights of the ammonia liquid and vapour may be as much as 5 to 1 at evaporator outlets compared with the ratio of the vapour to liquid volumes which will possibly be in the order of 70 to 1. This indicates that the outlets from the evaporators contain only wet vapour. It is likely that this will be the case as the velocity of the vapour will be such that the liquid particles will be carried along to form a mist. It is, of course, possible that slugs of liquid will be carried to the outlet of the evaporators particularly during load increases and also in the case of bottom feed evaporators.

Q. What pipe sizing is recommended for the pump systems ?

A. In order to achieve the most satisfactory results careful attention should be paid to the pipe sizing for these systems.

In the case of the supply lines to the evaporators, if these are undersized there will be insufficient pressure available at the throttling valves or orifices to meter the required quantity of ammonia through these. It is possible for flashing to take place in the pump discharge lines if they are undersized particularly in view of the heat leakage into the lines resulting from these being at lower than ambient temperatures in most cases. If flashing should take place distribution problems may develop.

The velocity through these lines should normally not be in excess of 3 ft. per second which for a 3 in. line gives about 4,200 gallons per hour, a 2½-in. line 2,800 gallons per hour, a 2-in. line 1,900 gallons per hour, a 1½-in. line 1,200 gallons per hour, a 1¼-in. line 900 gallons per hour, a 1-in. line 480 gallons per hour, a ¾-in. line 300 gallons per hour and a ½-in. line 180 gallons per hour.

In the case of the wet return lines from the evaporators it should be borne in mind that, in view of the fact that the weight of the liquid and vapour mixture is considerably more than that of saturated vapour, the pressure drop for any given conditions will be much greater than for saturated vapour. The return lines should, generally speaking, be one size larger than dry suction lines for the same tonnage and evaporating temperature conditions. By undersizing the return lines similar penalties are imposed on the system as by undersizing suction lines, the increased pressure drop causes higher evaporating temperatures than would otherwise exist if correctly sized lines were used.

Calculations were recently made for a specific application to demonstrate the penalty which can be imposed on a system by circulating too much ammonia by means of a pump. The pressure drop per 100 ft. of 2½-in. bore pipe was calculated for a 12 ton refrigeration load at –40°F. suction temperature (8·7 in. vacuum). It was found, assuming dry vapour returning from the evaporator, that the temperature at the outlet would be approximately –39 °F. If liquid was recirculated on the basis of 5 to 1 the temperature at the evaporator outlet would be approximately –37 °F. For 10 to 1 the outlet temperature would be approximately –35 °F. and for 20 to 1, –31 °F.

Q. What length of pipe per circuit can be used in the evaporators ?

A. As with any other type of system the length of pipe per circuit will vary depending on the pipe diameter, evaporating temperature and loading factor

(*i.e.* Heat Transfer Coefficient X Temperature Difference). The pressure drop in any circuit is also a direct function of the friction factor for a given pipe and the fluid density. The friction factor, determined by Reynolds Number, increases with the fluid density. From the foregoing we can observe that the pressure drop for a given evaporator under similar load and evaporating conditions would, in the case of pump circulation, be in excess of that realized for direct expansion operation.

It is therefore important to keep the length of circuits to a minimum.

The following table, No. 1, gives recommended maximum tonnages per feed for 1¼-in., 1½-in. and 2-in. bore pipes at various evaporating temperatures and loading factors.

Q. Where must the accumulator be located relative to the evaporators ?

A. The accumulator can be located in any position relative to the evaporators; however, the relative positions affect the design and performance of the equipment. It is desirable in order to facilitate defrosting, oil removal and for limiting operating charge to locate the accumulator below the evaporators. In this case the plant is connected up to provide top feed to the coils and circuits so that the liquid ammonia drains into the accumulator. The oil also drains into the accumulator so that it can be readily removed. By virtue of this free draining arrangement the time of the hot gas defrosting cycle can be reduced as it is not necessary either to pressurize the liquid to force it out of the circuits or to heat any large volume of liquid to the defrosting temperature.

In view of the fact that large quantities of liquid refrigerant can be deposited into the accumulator it is necessary to size this vessel to accommodate all the ammonia which it will be required to hold and at the same time to provide separating space to disengage the liquid particles from the vapour.

If the accumulator is located at the same level as or above the evaporators the ammonia inlets to the latter are usually arranged to bottom-feed. The refrigerant charge per evaporator is increased by comparison with a top feed arrangement. The accumulator will be smaller than for a top feed system but will, nevertheless, have to be selected to accommodate slugs of liquid which will return following load increases and during defrosting.

Q. How is the accumulator sized ?

A. As indicated previously the holding capacity of the accumulator will be basically determined by the relative positions of the accumulator and evaporators. The main purpose of the accumulator is, nevertheless, to act as a separating vessel so that it should provide sufficient cross-section at all times to reduce the wet return vapour velocity to a degree where the liquid will separate from the mixture thus ensuring that dry gas only will be drawn to the compressor. The minimum cross-section should ensure a gas velocity not in excess of 150 ft. per minute.

The accumulators can either be vertical or horizontal vessels. In view of the fact that it is always desirable to provide at least 5 ft. liquid head for the recirculating pump suction the horizontal vessel frequently has to be used so that it can be accommodated within the machinery room. The advantage of the vertical vessel is that the cross-section area is constant irrespective of the quantity of liquid in the vessel so that the disengaging velocity is maintained at all times. In the case of the horizontal vessel the

Evaporating Temp. Degrees F.	+15			-15			-40		
Loading Factor ("K" x M.T.D.).	30	60	90	30	60	90	30	60	90
1¼" N.B. Pipe	1·6	2·1	2·45	1·24	1·64	1·92	0·98	1·3	1·53
1½" N.B Pipe	2·05	2·65	3·26	1·61	2·08	2·42	1·28	1·65	1·92
2" N.B. Pipe	3·7	4·84	5·88	2·9	3·77	4·6	2·3	3·00	3·65

Table showing Maximum Tons Refrigeration per Feed for different Pipe Sizes, Loading Factors and Temps.

Table 1.

velocity is reduced as the liquid level rises. In large down-feed systems an economic advantage may be shown by using a horizontal accumulator with a separate vessel over it suitably connected to provide separating facilities.

For bottom-feed systems where the coils are below the accumulator the latter should be sized to provide between 25 and 35 per cent. of the coil volume.

For systems with the coils above the accumulator the vessel must have separating space and hold all the liquid ammonia in the pump discharge connexions, plus that in the evaporators plus the ammonia in the return lines.

The discharge lines will be filled with solid liquid which for every 100 ft. of ½-in. pipe gives 0·21 c.ft., for ¾-in. = 0·37 c.ft., for 1-in. = 0·6 c.ft., for 1¼-in. = 1·02 c.ft., for 1½-in. = 1·41 c.ft., for 2-in. = 2·33 c.ft., for 2½-in. = 3·33 c.ft., for 3-in. = 5·12 c.ft.

The quantity of ammonia in the coils will be approximately 25 to 40 per cent. of the coil column for top-feed circuits and 65 to 80 per cent. of the coil volume for bottom-feed circuits depending on the loading.

The quantity of ammonia in the wet return mains on a down-feed system should be based on 20 per cent. of the volume of the return connexions.

It is bad practice to undersize the accumulator as, apart from the possibility of operating difficulties resulting from a finely sized vessel, we should always bear in mind the fact that it may be necessary to increase plant capacities in the future. It is usually a more complicated operation to replace or increase the capacity of an accumulator than any other component in a system.

Q. How should the liquid level be maintained in the accumulator ?

A. By means of any of the usual level control devices such as a low pressure float valve, a low pressure float switch/solenoid valve combination, an electronic control device or a thermal operated control adapted for the maintenance of liquid levels. A high pressure float valve can also be arranged to feed directly from the condenser or high pressure receiver into the accumulator.

It is good practice to install both high and low level float switches for safety controls. The former can be arranged either to stop the compressors or actuate an alarm device; the latter should be arranged to stop the pumps as it is bad practice to operate these without liquid in them.

Q. What measures should be taken when connecting up the liquid pump or pumps ?

A. First and foremost ensure unrestricted flow of ammonia to the pump to prevent flashing and cavitation problems. The height of the liquid level should always be in excess of the frictional loss into the pump inlet. If the reverse is the case the capacity of the pump will be reduced.

A vent connexion should be made between the pump suction connexion and the top of the accumulator to allow any gases formed in this line to be vented; this connexion can remain open at all times. it is good practice to use an angle valve at the pump suction rather than a straight through globe valve as the flow resistance is about 50 per cent. less for the angle valve. In the event of a straight through valve being used it should be located with the spindle on a horizontal plane to prevent gas locking from taking place.

A check valve should be fitted to the discharge line of each pump in the event that liquid can flow back into the accumulator from the discharge line during the pump off-cycles.

A discharge gauge should be fitted to the pump. The liquid leg should incorporate an adequately sized oil draining arrangement.

Q. In the event of a pump breakdown is it possible to operate the system ?

A. At the time of installation a by-pass line fitted with a hand expansion valve should be connected between the high pressure liquid line, before this enters the float valve or other liquid level device, and the downstream side of the pump discharge valve. If the pump is off, the liquid can by-pass the accumulator and pump and be fed to the evaporators as in a manually operated hand expansion system. The throttling valves will have to be adjusted to provide the necessary regulation. Any liquid which may overfeed will be separated out in the accumulator but it will be necessary to ensure that the level in the latter does not rise above safe limits as there will normally be no means of returning this to the high pressure side of the system.

Summary

In the foregoing paragraphs we have endeavoured to explain the function of the various components which make up a liquid pump recirculation system and to establish exactly what takes place within a system.

There are many additional accessories which can be added to these systems over and above those described. We have no doubt that in the years to come more controls and accessories will be made available. It is anticipated that many more users will come to realize the advantages which can be obtained by employing ammonia liquid pump recirculation and that installations will become even more numerous than at present.

One of the first engagements of Lord John Hope, the newly appointed Minister of Works, will be the official opening of The Building Exhibition on Wednesday, November 18. Recognized as the "shop window" of the building industry, this exhibition, to be held at Olympia, London, from November 18 to December 2, promises to live up to its reputation. There will be more exhibitors than ever before—including exhibits from Africa, Australia, Belgium, Canada, Denmark, Germany, Portugal and Spain. One Canadian firm is forming a new company in Britain which will be launched at the exhibition.

MARKET FOR DOMESTIC ELECTRICAL EQUIPMENT IN THE LEBANON*

THE use of domestic electrical appliances is well rooted in Lebanon and possibly, on a *per capita* basis, Lebanon has a higher rate of use than any other Middle Eastern country. The most widely used items are refrigerators, washing machines, water heaters and electric irons. Other articles such as air-conditioners, kettles, fans, dish washers, toasters, heaters, grills, and waffle irons are offered for sale but their market is more restricted. Comments on the market possibilities of each of these articles are given later in this report and import statistics for the years 1956, 1957 and 1958 are given in the annexe.

There are no restrictions on the importation of these appliances but customs duty is levied on each ranging from 25 to 40 per cent. An official rate of exchange of £stg.1 = £Leb.6·19 is used in assessing duty and the percentages do not work out so high in practice as the current commercial rate of exchange is in the region of £stg.1 = £Leb.8·85.

Local Manufacture

There is local manufacture of air-conditioning units produced by Universal Refrigerating and Equipment S.A.L., which started production in 1957. The factory was closed in 1958 but production has now started again and 2,000 units are expected to be produced in 1960. The units are of the ¾-h.p. type and retail at around £Leb.650. The same firm has plans for producing a utility refrigerator in the near future. There is no other local production of the commodities mentioned in this report.

Refrigerators

The United Kingdom is one of the suppliers of refrigerators but American models have so far enjoyed greater favour. The standard size on demand is in the 9- to 12-c.ft. range, *i.e.* the standard American model, and refrigerators of this size are found even in the most modest homes. Styling, interior fittings, gadgets and price are all selling points coupled with the credit facilities available from the distributor. German models have been gaining in popularity over the past few years and part of this popularity undoubtedly springs, not from customer demand, but from the importers themselves, who find that they can make bigger margins on German models. The more popular German and American models are as follows :—

American	Co-op
Philco	Admiral
Frigidaire	Evercold
Westinghouse	Coldspot.
General Electric	
Norge	*German*
R.C.A.	Silo
Amana	Linde
Deep-freeze Duplex	Bosch

Prices are higher than might be expected but most sales are on credit of a period of from 12 to 24 months and such credit sales are often financed on local private loans for which high interest rates are charged. The price range is as follows :—

		£Leb.
4– 6 c.ft.	...	500– 700
9–12 ,,	...	700–1,500
13–16 ,,	...	1,700–1,900

The 4- to 6-c.ft. size is found mainly in bachelor apartments and in offices and rarely seen in ordinary households. The larger sizes include spacious deep-freeze compartments, bottle racks, egg racks, butter compartments, vegetable drawers and the like. An interior light fitting is a " must " and a refrigerator without this would cause raised eyebrows even from a mountain peasant.

Air-Conditioners

Air-conditioning in the home is a comparatively recent innovation in Lebanon but one which shows signs of becoming popular. In the summer months of June, July and August the climate in Beirut is very humid, and it has been a tradition for those who could afford the money to rent a house in the mountains for these few months. Air-conditioning in the home has found favour with people who did not particularly like the daily commuting from the mountains to Beirut and an air-conditioner can be bought for approximately one season's summer house rent charge. Some of the new blocks of flats have built-in air-conditioners in each apartment and the same window units have been fitted in some of the hotels. All the models offered for sale in Beirut are of the ¾-h.p. or 1-h.p. style and prices range from £Leb.700 upwards. Most popular models are Westinghouse, G.E.C., Philco, Worthington, Kelvinator, Carrier and Universal—all of American origin. Neither British nor German competition is apparent, but the market prospects would seem to be promising for any United Kingdom manufacturer prepared to undertake the usual hazards of breaking into a market.

Prices

It is said that East meets West in Beirut but on the matter of retail prices the East prevails. Margins are just as high as can be made and bargaining is the order of the day. Fixed prices are said to be charged at certain shops and stores but bargaining is not unknown here either. Importers may make as much as 25 per cent. after paying all local charges and the retailer certainly does not make less. Credit financing is often by means of private loans and the rates for such loans may be from 8 to 12 per cent. The retail price for a credit sale will therefore be much higher than for a cash sale, and most retailers selling on credit find it necessary to employ people to collect the instalments.

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* *By courtesy of Board of Trade. Report prepared by British Embassy, Beirut.*

NEW FROZEN FOOD STORE

HAVING operated with conspicuous success a frozen food store of approximately 4,000 c.ft. since 1947 for the distribution of several leading brands, G. J. Wright (Frozen Foods) Ltd., of Redhill, recently completed a £100,000 development programme and have trebled their storage space, besides constructing a new office block. Their fleet of refrigerated vehicles has been considerably expanded.

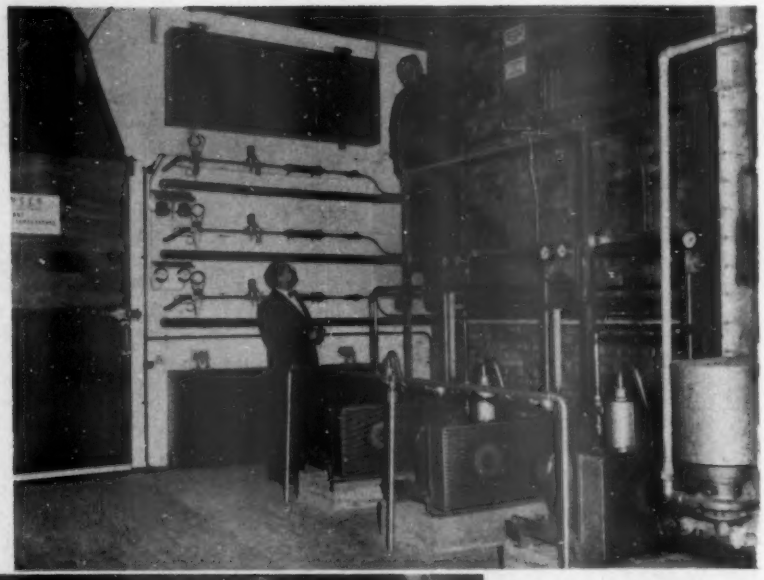
The new cold store of 13,000 c.ft. is held at minus 10° F. for the storage of frozen foods. Built in three sections and ganged in one holding rack, each section is independently connected to a compressor. The coil rack is constructed so as to allow either of the coils to be withdrawn if required, enabling the cold store to continue in operation if repairs became necessary to any section of the evaporator. The air circulation is provided by two 24-in. fans with total capacity of 12,000 c.ft. per minute.

Defrosting of the evaporator is by ambient air and water, the water sparge pipe being fitted with freeze-proof jets. Ambient air is used in conjunction with the water by the use of reversed fan operation, the coils also being dried off by this method after defrost. The operation of defrosting can be carried out completely within 30 minutes, without appreciable temperature rise in the cold store, and is based upon the system installed with the 4,000-c.f. cold store also

Mr. T. G. Baker, managing director, to whose designs the new cold store and lorries have been built, explains to "M.R.'s" representative the telephone selling technique practised at Redhill. Every frozen food item is listed on the wall. Eighteen telephone lines are in constant use.

The sub-zero store which was recording −16°F. even when loading was in progress.

Right: The refrigeration plant area fitted with every conceivable automatic and safety device.



Below: Special design of ducting to ensure even delivery of air.

operated by the users, in which trouble-free defrosting has been carried out twice weekly for the past five years.

The refrigeration units comprise three Sternette 7½-h.p. W 750 AL/RH compressors, complete with oil separators and Penn oil pressure switches, to guard against undue oil loss. Each compressor, installed for manual control or ganged for auto operation, has a total rated capacity of approximately 72,000 B.t.u./hr. at minus 20° F. It is estimated that for normal running with shell and tube condensers, approximately 20 gal. of water per minute would be required; however, the compressors are connected to a 12-ton induced-draught water condenser, making for great economy with low head pressures and using very little water.

The installation of the foregoing plant was undertaken by Refrigeration South Coast, of Hove.

One of the fleet of new mechanically-refrigerated Ford vans.

The Present Status of the Plastics Industry

By Dr. V. E. YARSLEY, F.P.I.

IN common with the chemical industry generally, plastics continue to report good business, and this extends also to the engineering and plant sections. This is a propitious augury for an industry in which the capital equipment per worker is higher and where a fall in output consequently brings a proportionally larger drop in profit. The unaudited results for the first six months of 1959 published by Monsanto Chemicals show that sales were up by 16½ per cent., gross profits up by over one-third, and net profits by half. These figures, of course, cover all the activities of the company, and although during the period under review some units of the new polythene plant at Fawley came on-stream as scheduled, and the on-stream time continues to increase, it is stated that the contribution these made to the financial results is not significant, so that the credit for the higher profits belongs to greater sales of older established products and the greater efficiency of their manufacture. It is encouraging to note that this improved trend continued in the second half-year of 1959, and that improved profit margins of 8·3 per cent. of sales (against 9·1 per cent. a year earlier) are recorded. Export sales accounted for 37 per cent. of the Monsanto sales. Excellent results have also been published by Albright & Wilson, a company with diverse chemical interests, including among them raw materials for plastics. This company is currently sponsoring development of specialist phosphorus-based plastics, and earlier this year published details of these very interesting materials which may eventually meet the growing need for high performance materials of improved heat resistance.

Details of net sales of plastics in U.K. for the first three months of 1959 have been published by the Board of Trade, and these again show an increase over last year. Total sales are given as 112,273 tons, with thermoplastics at 67,601 tons, increasing its lead over the thermosetting materials which totalled 44,672 tons. In the latter category, alkyds at 11,505 tons still constitute a surprisingly large percentage of the total, whilst the closely related polyesters at 1,484 tons appear low in view of the progress which has been made in the use of polyester/glass fibre laminates. In the thermoplastic field, p.v.c. in its various forms still holds first place, with plasticized sheet at 8,101 tons approaching the figure for moulding and extrusion compounds at 10,214 tons. Polystryene moulding and extrusion compounds totalled 7,476 tons, but it is impossible to assess the progress of the third member of the " poly " group, polythene (polyethylene), since this is unfortunately still included under the general heading of other thermoplastics, which also includes the acrylics, nylon, p.t.f.e., etc., and totals 34,724 tons. The U.K. exports of plastics materials for April 1959 were 12,396 tons, 30 per cent. more than the same period in 1958. Exports for the first four months of 1959 were 48,020 tons, compared with 38,618 tons last year. The general progress in the plastics industry is reflected in *The Financial Times* index which, for the week to August 26, reached the all-time high of 200·5, against a basis of 100 at the end of 1949 and compares with a low of 87·5 recorded in November 1952.

Details have recently been published by Baxenden Chemical Co., of Baxenden, near Accrington, Lancs, of the new expanded plastics material they have developed. This is known as Spandofoam 200 and is a two-component polyether-based polyurethane resin foaming system that produces low density, rigid polyurethane foam with outstanding load bearing and thermal insulating properties. The foam is produced by the expansion of " Freon " type gas. When properly mixed and poured into a cavity, the liquid composition expands to fill the void space and cures to the rigid foam, the curing process taking place at room temperature without the application of external heat. When expanded in place, the foam will form a good adhesive bond with most clean surfaces. Spandofoam 200 part A is made up of isocyanate, ether glycol resin and emulsifier. This isocyanate-terminated polymer will react with water and must, therefore, be protected from contamination by atmospheric moisture. All part A containers should be closed when not in use in order to minimize the gellation possibility. The part B component is made up of ether glycol resin, catalyst and " Freon " type blowing agent. This container must also be kept closed when not in use, because of the tendency of the

blowing agent to evaporate over a period of time. Both components may be stored at room temperature. The foaming temperature of the two components will be determined by the type of cavity to be filled. It is, however, not possible to generalize. The foam density will be lower as the temperature is increased. The heat applied to the polymer before foaming and the heat generated by chemical reaction during the foaming cycle are used to vaporize the liquid " Freon " in the resin. The heat generated is sufficient to cure the foam after expansion has ceased. The polymer component (part A) is normally warmed to 100° to 110° F., while the resin component (part B) is added at a temperature of about 70° F. The resin should not be heated so that the " Freon " evaporation rate will be minimized. The mould condition is important. The heat generated must be maintained in the expanding foam and not dissipated through the part being filled, and it may be necessary to warm the mould before foaming. The following physical properties were determined on free blown, machine mixed foam samples : Mechanical—density (lb. per c.ft.), 2·1 ; tensile (p.s.i.), 44·0 ; elongation (per cent.) 3·8 ; compressive yield strength (yield point at 9 per cent. deflection), 43·4 ; elastic modulus in compression, 48·0 ; heat distortion temperature, 110° C. ; closed cell content (per cent.), 90 ; water absorption (8 ft. head for 48 hrs. lb./c.ft.), 3·2 ; moisture vapour transmission (grains/sq. ft./hr./in. of mercury), 6. Electrical—dielectric constant (500 KC. per sec.), 1·22, (1,100 KC. per sec.), 1·25 ; dissipation factor (500 KC. per sec.), 0·003, (1,100 KC. per sec.), 0·001. Thermal—K — B.t.u./hr./ft.²/°F./in. (original), 0·11 (at 75° F. mean) ; K — B.t.u./hr./ft.²/°F./in. (after ageing for eight weeks at 50° C. and remaining constant thereafter), 0·145 (at 75° F. mean).

To keep pace with the rapid development of new plastics materials, parallel development has to take place to effect the improved production of ancillary raw materials such as plasticizers, dyestuffs and pigments, which are used therewith. Since colour is one of the outstanding properties of plastics materials, it has been essential not only to see that the colour stability of colorants keeps pace with the increased thermal resistance of the polymers, but also to ensure that the colorant is stable at the processing temperature of the polymer. Polythene users will be particularly interested in the data recently published by The Geigy Company of Rhodes, Middleton, Manchester, giving the results of tests on the latest range of colours they have developed specifically for high-density polythene. Polythene is outstanding among the newer plastics materials for the rapid increase in its use in the manufacture of industrial and domestic products. It is now available in several grades, under various trade names, each produced by a different process to give end products of different densities, melt indices, flexibilities and purities. Each grade also has an optimum range of temperature for processing. To-day these temperatures vary from 180° C. to the region of 300° C., and thus some colours formerly considered satisfactory are no longer stable enough at the new higher processing temperatures. At the same time, heat stability is only one of many relevant factors. Others of importance are light fastness, ease of dispersion, shade, brilliance, opacity or transparency, freedom from migration, non-toxicity, and cost. Although inorganic pigments have adequate heat and light stability for most purposes, their usefulness is generally limited by high opacity, tinctorial weakness and lack of brilliance. They are often toxic and are rather expensive. Organic pigments on the other hand vary as to heat and light stability in polyethylene from poor to as good as the best of the inorganics. In addition they span a much wider range of shades, and are bright, strong, can be transparent, are easy to disperse and relatively cheap. All these points must be considered in relation to a particular application in choosing a colour to give a satisfactory performance, economically and technically, under specified conditions. To meet the growing demand for colours for polythene, Geigy have reassessed their available organic pigments and offer a range selected specially for heat and light stability and freedom from migration.

An interesting addition to the rapidly increasing range of polyester/glass fibre products is a new all-plastics boat. The " Witcat " semi-catamaran is now being manufactured by James Whitson, the well-known coachbuilders. The 16-ft. " Witcat " is constructed throughout with British Resin Products' Cellobond polyester resins and glass fibre and has twin hulls which, unlike the normal catamaran, converge until the two bows are only some 2 in. apart. Above the surface, however, the craft has the low design appearance of a normal yacht. The " Witcat " has been designed as a dual-purpose boat giving a first-rate performance under sail or when motor driven. For the yachting enthusiast the twin hulls provide exceptional stability and have been developed to allow easy handling and planing at all speeds. When used with a motor the " Witcat " can seat eight people comfortably. It is ideally suited for use as a harbour runabout or as a pleasure boat. It has an excellent sea-going performance and the twin hulls provide a high level of safety even in choppy waters. Positive buoyancy is built into the boat in the form of 9 c.ft. of expanded polystyrene. The twin rudders moulded in polyester/glass give maximum steerage and specially designed attachments cater for easy fixing and removal. The " Witcat "has a most attractive colour scheme of red and blue and the deck has been pigmented pale blue. As the polyester/glass is self-coloured the time-consuming and expensive ritual of annual repainting is eliminated. There is no possibility of rotting and in the event of an accident damage can be swiftly repaired. The " Witcat " can be trailer-towed by any car and presents no storage difficulties as it can be left in the open without detriment to the structure.

Copies of the 1960 Refrigeration Diary are now completely sold out.

QUICK-COOLING OF MEAT

ITS PURPOSE AND MEANS

By H. G. VANDALL and E. CHRISTIANSEN*

FOR more than half a century, cooling of meat has been one of the main purposes of refrigeration, and it is therefore remarkable that within the last 8 to 10 years such a considerable—almost explosive—development has taken place within this field caused by the introduction to slaughterhouses of the quick-cooling process—a development which having passed its maximum is still far from being concluded. For the existing slaughterhouses, the introduction of the quick-cooling process means a reorganization of production with arrangement of special cooling tunnels and/or cooling rooms eliminating the hanging-halls previously used, the meat being taken directly to the cooling rooms after slaughtering.

In this connexion it can be mentioned that not only is quick-cooling aimed at after the meat has been taken into the cooling room, but it is also of the greatest importance that the time interval from the completion of slaughtering to the intake into the cooling room is as short as possible.

All kinds of meat are now being treated according to the new principle. Depending on the character and size of the slaughterhouse in question each cooling room is arranged separately for cooling :

(1) Pigs.
(2) Beef cattle.
(3) Beef cattle and calves.
(4) Pigs, calves, and sheep.
(5) Plucks.

In Europe, quick-cooling of pigs on a larger industrial scale is taking place especially in Denmark and Holland, while the largest special plants for beef cattle are found in Germany, Holland, and Belgium. The principle of quick-cooling of different—usually smaller—animals simultaneously is known among others from Finland and Norway. For several years, Danish pig slaughterhouses have used separate rooms for quick-cooling of plucks, and the process in these rooms is now often combined with a slight degree of freezing in connection with dispatch over longer distances.

The importance of quick-cooling can be summarized in the following points :

(1) Reduction of shrinkage.
(2) Improvement of quality.
(3) Shorter time of production.

Reduction of Shrinkage

The most conspicuous advantage is definitely the achieved reduction in shrinkage in comparison with both pre-cooling in a hanging-hall as well as in pre-cooling rooms for slow cooling which are employed in some slaughterhouses. By the reduction of shrinkage a profit in the form of larger net production quantity of the same gross material is accomplished which will allow a complete write-off of the investment of the quick-cooling rooms within a comparatively short time.

For a bacon factory of average size, slaughtering 150,000 pigs a year, even a reduction in the shrinkage as small as one per thousand will, according to Danish price conditions, mean an annual excess profit of about D.Kr. 50,000.. A comparison between loss in the hanging-hall and in the quick-cooling tunnel made by professor G. Lorentzen, Norway, shows a reduction of about five per thousand for beef as well as for pork and mutton. Statements from Danish sources show an even larger reduction especially for pigs which are taken to the cooling rooms immediately after slaughtering.

The reason for the smaller shrinkage is primarily the quickly attained low surface temperature whereby the difference of vapour pressure between the air in the room and the surface of the meat will be small with consequently small evaporation of water. The relative humidity has, of course, some influence in this connexion, but for the quick-cooling process proper it is of secondary importance compared to the temperature of the air. The air speed has no direct influence on the shrinkage. but indirect by influence on the surface cooling period.

When cooling cattle the dry surface—a thin membrane which is formed at once—is an essential factor for small shrinkage as well as for the quality, and it is very important to preserve this membrane during cooling, however, without a more shrunken skin being formed by excess drying.

Improvement of Quality

The improvement in quality originates above all from the strongly reduced possibilities of bacterial growth owing to the low surface temperature. Naturally, the quicker stagnation of the bacterial growth will also influence the durability. Changes of the colour of the meat may occur as a result of the cooling, and some writers state that in the case of pigs the rind can be slightly red coloured. As far as we know this has not caused any concern in Danish slaughterhouses. Beef keeps a fresher colour when quick-cooled, and the tallow remains lighter than with the cooling methods previously used.

Shorter Time of Production

Both for beef cattle and pigs quick-cooling involves a shorter production time and consequently essentially less space requirements, as the area previously used for hanging-halls can be used for other purposes or

* Atlas Limited.

for an increase of the production. Thus it is possible to slaughter every day—normally the first five days of the week—using the same quick-cooling room. Fattened calves and beef cattle can be ready for further treatment or dispatch 18 to 24 hours after being taken into the cooling rooms, and in the case of pigs even faster. For bacon pigs this means that the cutting can be started in the morning the day after the slaughtering.

How is Quick-Cooling Arranged in Practice ?

The quick-cooling can be arranged according to two different systems :

(i) *The Tunnel System*, where the first stage of the cooling is performed in a cooling tunnel, usually with mechanical transport of the carcases, while the second stage takes place in after-cooling rooms which can also be used for short-time storage.

(ii) *The Charge System*, where the whole cooling takes place in the same room and where the cooling must therefore be divided in a quick-cooling period and an after-cooling period. This system requires an adjustability of the coolers so that they will suit the different working conditions during the two periods.

Either wet coolers or dry coolers are used for both systems.

The Wet Coolers can be brine spray floor units equipped with cooling coil of bare pipes, nozzles, eliminators, centrifugal fans, and air diffusers. Sodium chloride is used as brine. To avoid the problem of corrosion propylene glycol may be used instead. In both cases there must be reckoned with the cost for replacement or concentration of the brine. Dry coolers are therefore being used more and more as they require less maintenance.

The Dry Coolers are made either with spiral finned tubes or as laminated coolers (finned coils). In the tunnels the coolers of spiral-finned tubes are usually placed on the floor, whereas the laminated coolers can often be suspended under the ceiling due to the lower weight. Atlas have developed a registered design of twin laminated cooler, specially designed for suspension under the ceiling. Each cooler has two cooling coils and one fan. The distance between the fins is 10 mm. The cooling surface in a tunnel is dimensioned so that it is sufficient to be defrosted once a day by means of the fans after completion of the cooling.

The two quick-cooling systems will now be described in more detail.

I. Tunnel System for Pigs

This system is advantageously used in several larger slaughterhouses, where an almost constant number of pigs is slaughtered every day with not too much variation in the slaughtering weights.

From the slaughtering room the pigs are taken to the tunnel by a continuous conveyor. Here the pigs are transported by another conveyor through the tunnel so that manual work is avoided there. In the existing tunnels the throughput time has been about 1½ to 2 hours, the air temperature being –6 to –8° C. The air circulation is very fast, up to 3 or 400 changes per hour. After passage through the tunnel the surface temperature of the pigs has been reduced to about 0°C., while the bone temperature is reduced by +10/+12° C., i.e. to about +25° C. Wet coolers for the tunnel are dimensioned for 15 to 25 m^2 cooling surface per ton meat per hour, while dry laminated coolers are dimensioned for 120 to 180 m^2 correspondingly.

From the tunnel the pre-cooled carcases are distributed to the various after-cooling rooms having no mechanical transportation. The after-cooling can be extended according to requirements, a period of 14 to 16 hours is quite normal, as the pigs, as previously mentioned, should be ready for further treatment or dispatch on the morning after the slaughtering day.

Variations in the duration of the after-cooling period have only a slight influence on the shrinkage. In the after-cooling rooms the air circulation varies between 20 and 60 changes per hour.

The after-cooling rooms are also arranged either with wet or dry coolers. As the transmission losses are of great importance for the dimensioning, just as a varying number of hours may be available for the after-cooling as mentioned previously, it is very difficult to state an average figure for the size of the cooling surface.

Combined Cooling

Combined cooling is in several cases used in the after-cooling rooms, *i.e.* natural convection air-cooling by means of finned tubes for removal of the transmission losses, and cooling with forced air-circulation by means of laminated coolers for removal of the remaining heat in the carcases.

The refrigerating plants are usually made for fully or semi-automatic operation. The refrigerant supply is controlled by float valves or thermo-valves, and solenoid valves are placed on both suction and liquid line for each room.

In tunnels the suction line is further supplied with a back pressure regulator—in case the compressor in question is not already capacity regulated controlled by the suction pressure—as it is desirable to obtain a constant and adjustable evaporation temperature in the coolers.

In after-cooling rooms which are to be maintained at a constantly high relative humidity the suction lines are also supplied with back pressure regulators. The air temperature which is normally kept at + 2 to +4° C. is controlled by means of room thermostats, and if the after-cooling rooms are also to be used as storage rooms, it will be of importance to have the back pressure regulators equipped for two different suction temperatures. The fans of the laminated coolers can be made pole changeable, *i.e.* with variable air capacity.

(to be continued)

REFRIGERATION

for Freezing ★ Storage ★ Display

The cold store of Eskimo Foods Ltd., Cleethorpes, is noteworthy as the first large installation of its type in this country to use finned cooling grids. The two large chambers, each with a capacity of 400,000 ft.³, and a smaller room of 35,000 ft.³, are automatically maintained at −20° F. by compound compressors made by J. & E. Hall.

J. & E. Hall design and manufacture all types of refrigerating equipment for the freezing, storage and retail display of quick frozen foods.

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AP 303

Problems solved from cold NUMBER 13 IN A SERIES

By Appointment to Her Majesty the Queen
Manufacturers of refrigerating machinery
Pressed Steel Company Limited

How we kept a Bloodhound hot on the scent

During the count-down before launching, the closely packed and complex electronic equipment installed in the Bristol/Ferranti Bloodhound is automatically checked to ensure maximum reliability of the missile in flight. This raises an additional problem for, during the pre-launch period, heat is generated; heat which could impair the reliability and performance of the Bloodhound. To combat this, an efficient cooling system must be provided.

BRISTOL/FERRANTI ASKED PRESTCOLD

Bristol/Ferranti brought this problem to Prestcold. Naturally enough, because we have vast experience of refrigeration. Our equipment is extremely versatile. And although this was strictly a space-age job, it was no more difficult than a whole series of problems that we had already tackled successfully for people in various branches of industry, commerce and science.

THE PRESTCOLD SOLUTION

Precise details of the Bloodhound and the Prestcold equipment used at the launching site may not be published. But we can say that our equipment provided a full solution to the problem.

It is thanks to Prestcold refrigeration that the Bloodhound is kept at the correct temperature while on the launcher, thus ensuring that after launching, the Bloodhound stays hot, but not too hot, on the scent.

HOW PRESTCOLD CAN HELP YOU

Intense research, close attention to detail, experienced engineering — these qualities go into every Prestcold job, into the standard refrigerators and frozen food cases as well as into equipment made to meet a special need.

THE PRESTCOLD FARMOOR is full of fresh ideas. It has a multi-glazed display window; 11.1 cubic feet selling space for over 700 packets of frozen food; and a fully automatic complete defrosting system. The whole refrigerator is guaranteed for one year, its Super Presmetic Motor Compressor for five years.

Ask your Prestcold distributor, or Prestcold Commercial Sales Department, Cowley, Oxford, for more details now.

FOR FRESH IDEAS...IT'S

Prestcold

COMMERCIAL SALES DEPARTMENT · PRESTCOLD DIVISION
PRESSED STEEL COMPANY LIMITED · COWLEY · OXFORD

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Commercial and Industrial Section

MANUFACTURERS' AND DISTRIBUTORS' NEWS

see col. 3.

Zero Electric Ltd., Walsall, importers and distributors of the well-known Egelhof and Contardo products, have recently announced additions to the extensive range of products now available from both factories. The Egelhof valve factory is now producing three additional ranges of automatic valves, *i.e.* the type "DR," a suction pressure regulator for installation and individual control of multiple circuits operated from one machine unit. This valve is particularly useful for controlling liquid carry-over on circuits having a wide temperature difference. The type "LR," load capacity regulator, is a by-pass valve for fitting between the discharge and suction ports of the compressor and operated as an automatic by pass, smoothing out wide fluctuations in compressor performance on multiple circuits, and preventing oil foaming in the crank case. Model "STR" starting regulator valves for installation in the suction line immediately before the compressor, are particularly useful for holding down high evaporator pressure on low temperature plants where the refrigerant tends to liquefy and flow over in the evaporator circuit. They also protect the driving motor from starting overload and assist in reducing liquid knock and slugging in the compressor on the plant starting up. Full descriptive leaflets are available for all the above and will gladly be forwarded on application.

* * *

The Contardo range has been increased by the availability of a new ceiling-mounted, fan blown, cooler, designated model "AS," sizes, dimensions and B.t.u. output follow the AP range and cover from 580 B.t.u. per hour at 10° temperature difference for the AS.2, to 3810 B.t.u. per hour on 15° temperature difference for the model AS.10. The model AP.2 wall mounted cooler has the air circulating fan mounted in the front face of the shrouding to which is fitted an efficient drain tray with outlet for defrosting water; the AS model for ceiling fitting has the fan mounted in what is now the base shrouding to the cooler, which is also combined with an efficient drain tray complete with outlet, the air circulation being arranged to draw the air from the coldroom and discharge in a horizontal direction, parallel to the ceiling of the coldroom. The Contardo factory have also developed a wide range of air-conditioning coolers/heating coils, handling from 3/4 to 5 h.p. capacity for cooling and 215,000 to 417,000 B.t.e. for heating purposes. The cooling coils are designated "ED" for direct expansion application, type "W" for water cooling, and type "R" for hot water or steam heating. They have been designed for use in restaurants, stores, offices and dwelling houses, and in every case follow the same meticulous design and high class workmanship as the existing range of evaporators and condensers which, during the past two years, have been acclaimed throughout the industry.

The present Contardo factory in Milan, now employing over 250 workmen and technicians, will shortly be re-located in a new, large modern factory on the outskirts of the city, in order to cater for the vast increase in output which has become necessary during the past three years. Zero Electric Ltd., will be pleased to hear from existing and prospective clients should they be contemplating an overland trip on the Continent in the vicinity of either Stuttgart and/or Milan. They will be pleased to arrange for visits and hospitality at both factories at any time. In either instance, the visiting engineer can be assured of both a warm welcome and interesting and informative visit.

Mr. R. A. Bennett and **Mr. A. Cherrill** have returned from a visit to the Flica factory in Germany. An agreement was concluded replacing the provisional arrangement made last year and as from January 1, 1960, the respective companies, R. A. Bennett & Co. and Refrigeration Spares Ltd. are jointly named as sole agents for the United Kingdom. Both firms undertake to honour the guarantee implementation in respect of valves supplied by the previous agents. Mr. Bennett and Mr. Cherrill also visited the Kloeckner-Moeller headquarters in Bonn and the Martin Bitzer factory at Sindelfingen. (Bennett & Co. represent Kloeckner-Moeller and R.S.L. represent Martin Bitzer.) At the forthcoming Refrigeration Exhibition in London next February, Kloeckner-Moeller and Flica have individual stands and Bitzer condensing units will be shown on R.S.L's stand. The Flica exhibit will include a working circuit illustrating the applications of various auxiliary controls. Latest developments by Martin Bitzer include a 1½ h.p. semi-hermetic (air or water cooled) of most compact dimensions (illustration at top of page). Also a quadruple compound compressor of 20 h.p. with independent automatic cylinder unloading and fully automatic oil control. Bennett & Co. and Refrigeration Spares Ltd. market all three lines—Kloeckner-Meoller, Flica and Bitzer—under a co-operative arrangement and are pleased to report most encouraging progress during the past 12 months.

* * *

Hotelympia 1960. Britain's Hotel and Catering Exhibition which will be staged at Olympia, London, from January 19 to 28, will provide a panorama of progress in every facet of the catering industry. In addition to the 250 exhibitor manufacturers who will show 100,000 items of products for the trade, the cookery demonstrations, the Salon Culinaire,

COMMERCIAL & INDUSTRIAL

the new techniques in frozen food, cookery methods and many other services, will offer all in the catering business an opportunity to study the methods for improved efficiency at less cost. Trade conferences and special meetings will add to the scope of interest and most of the spectacular displays of equipment and cuisine will offer fresh opportunities and possibilities to every branch of the hotel and catering industry.

* * *

Mr. L. H. Meyer, M. Inst. R., has joined the refrigeration division of U.D. Engineering Co. Ltd., Park Royal, N.W.10. Mr. Meyer has specialized in flow refrigerating processes, and his function in this new

Mr. L. H. Meyer.

appointment will be to co-ordinate the design experience of the refrigeration and conveyor divisions of UDEC in the development of mechanized quick-freezing plants, ice cream hardening tunnels, and cooling and drying conveyors for food and chemical plants. The popularity of the frozen food counter at home and abroad, is making demands which are being solved by modern flow systems of preparation and packaging, and Mr. Meyer thinks that refrigeration techniques must be adapted to the continuous system, particularly in the food and chemical industries. Both refrigeration and conveyor techniques are closely involved and UDEC has the great advantage of long experience and considerable resources in both fields.

The 11th annual dinner of **Foxboro-Yoxall's** 10-year Service Club took place on September 11. The reception and dinner were held at the Wimbledon Hill Hotel and 117 long service members of the staff attended. One of the purposes of this annual dinner is to welcome to the club those members of the staff who have qualified for membership in the preceding year. The special feature of this year's dinner was that it marked the company's 25th anniversary, so that, for the first time, as well as 17 new members for the 10-year Service Club, there were six members who had completed 25 years' service. Mr. L. S. Yoxall, chairman and managing director of Foxboro-Yoxall Ltd., welcomed the new members and spoke of his pride and pleasure in the company's advance from small beginnings 25 years ago, to its present important position in the British instrument industry. He expressed his thanks to the long service members of the staff, whose efforts over the years had made this success possible. He concluded by welcoming the guest of honour, Mr. B. H. Bristol, president of The Foxboro Company, U.S.A. and his colleagues Mr. C. Schwarzler and Mr. Russ Milham, who had flown over for the occasion.

* * *

Worthington - Simpson Ltd., of Newark, Notts, announce an addition to their already extensive range of versatile " Monobloc " centrifugal pumps. The new range is designated type " DO " and comprises open impeller type pumps specially designed to handle slurries, paper stock, liquids containing small solids, and viscous liquids as well as clear liquids. Capacities of from 10 to 360 g.p.m. and heads up to 86 ft., depending on capacity, are covered by this range of pumps.

* * *

Mr. Walter Anderson Galbraith, B.A.(ENG.)., M.A. (CANTAB.), A.M.I. MECH.E., has been appointed general sales manager of **The Yale & Towne Manufacturing Company's** British materials handling division at Wednesfield, Staffs. Two promotions within the division have been made concurrently with this appointment : Mr. Harry Davis, assistant sales manager (United Kingdom), has been appointed sales manager (United Kingdom) and Mr. Michael John Stuart, assistant sales manager (export), has been appointed sales manager (export). All three appointments were effective from November 1, 1959. Mr. Galbraith, formerly chief sales engineer in Babcock & Wilcox's materials handling division, served with the Royal Engineers during the war, returning to Cambridge on demobilisation to take his degree.

* * *

Mr. Donald J. Flatman, F.R.S.A., M.INST.PKG., has recently joined the staff of **Anglo-American Plastics Ltd.,** extruders and convertors of plastics films for packaging and a member of the Commercial Plastics Group. Mr. Flatman, who is a packaging specialist will be concerned with the development of new outlets for the company's products. Since 1940 Mr. Flatman has been with the Nestle Company. He became a member of the Institute of Packaging in 1950, and as chairman of the education committee of the southern area is responsible for the organisation of the Institutes lecture courses in this region. This session 1959-60 is the third for which he has been responsible. Mr. Flatman is also a member of the Institute of Materials Handling.

* * *

Following the establishment of premises in Glasgow, **Merseyside Engineering (Refrigeration) Ltd.,** of Liverpool, announce the opening of new West End showrooms and offices at 28 Berners Street (off Oxford Street), London, W.1. The telephone number is Langham 0989 and Mr. H. P. Ross has been appointed manager. A London warehouse and service station are also under construction and this will greatly facilitate deliveries in the London area. The opening of new showrooms in Liverpool is also announced. These are at 89 Bold Street and the telephone number is Royal 8519. Merseyside Engineering also state that Showrooms for their range of " Everest " electrical domestic appliances will be opened shortly in Leeds, Bristol and Birmingham.

* * *

York Shipley Ltd., will be showing the model B.225 " Icelet " automatic ice-making machine which produces approximately 2 cwt. of pure, hygienic ice in pieces of uniform handy size every 24 hours, at the London Medical Exhibition from November 16 to 20. The machine starts and stops automatically to maintain the supply, while an integral insulated bin stores the ice until required. This ice is particularly suitable

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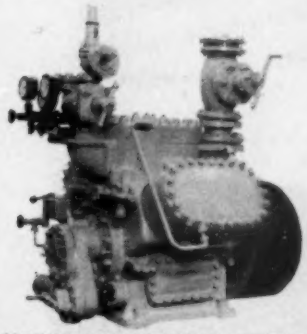
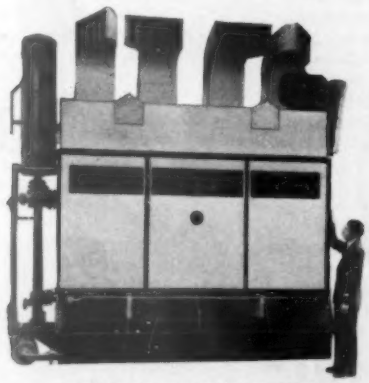


MODEL A.56 AMMONIA COMPRESSOR



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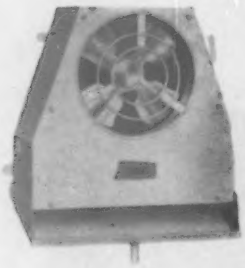
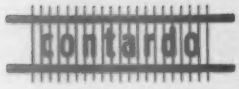
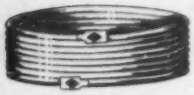
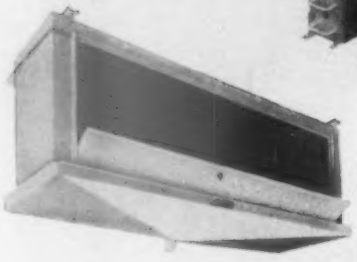






TUBING



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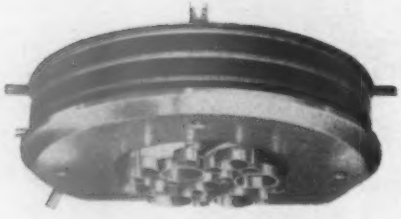
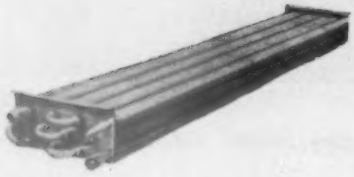
THERMOSTATS



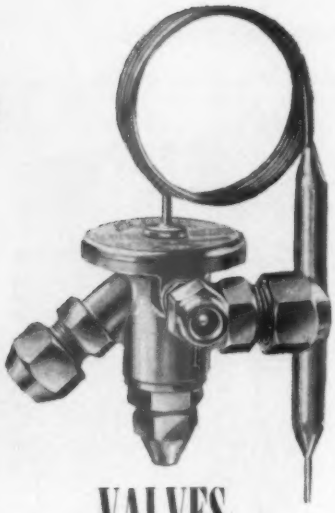
EVAPORATORS

BREEZA

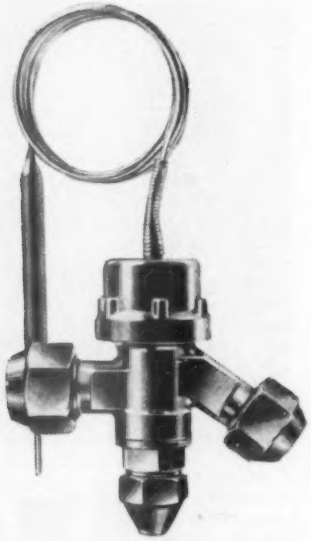
TROJAN FANS



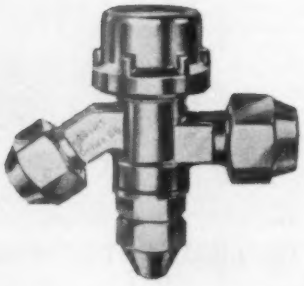
ZERO ELECTRIC
LIMITED
WALSALL • STAFFS



VALVES



EGELHOF



The bodywork and roof of this 1,050 c.ft. road haulage container is made entirely from assembled prefabricated polyester/glass panels which require no expensive metal supporting framework. The containers are supplied with top or bottom lift and are claimed by their manufacturer, Salmesbury Engineering Co. Ltd., to be over 25 per cent. lighter in weight and cost 25 per cent. less than more conventional containers. Bakelite polyester resin is used throughout in the manufacture of the containers which are particularly suitable for export markets.

* * *

for use in oxygen tents and also finds use in cold therapy as well as being valuable to the catering departments. Other products of this company include refrigeration equipment for the safe storage of food and drink and for blood and bone banks, mortuary cabinets, biologicals storage etc. This company also specializes in refrigeration for temperature and humidity control in operating theatres, laboratories and other similar areas as well as in rooms where these factors are important in the production and packaging of chemical, biological and pharmaceutical products. The latter applications will be displayed pictorially on stand 115 at the New Horticultural Hall.

* * *

A further order for cooling equipment for "Iscon," Durgapur, has been placed with **Heenan & Froude Ltd.**, of Worcester, by the Brightside Heating and Engineering Co. Ltd. The latest order is for four large Heenan-Marley Aquatowers and seven specially designed Heenan air coolers. Heenan's have now supplied all the air and water cooling plant required for the ventilation of "Iscon's" intermediate, blooming, billet and merchant mills, with a total of 10 water coolers and 25 air coolers.

* * *

Flexibox Ltd. have produced a new comprehensive mechanical seal catalogue in which is described the full range of Flexibox balanced and unbalanced mechanical gland seals for all types of rotary shaft equipment—pumps, mixers, agitators compressors, etc. This catalogue has been primarily designed to provide mechanical seal users with a rapid means of selecting the correct type and size of seal for any given application. To this end tables of essential dimensions, operating limits, power absorption and frictional heat development nomograms and details of PV ratings have been included. In addition a recommended materials specification for seal components is given for more than 350 fluids. Copies of the new catalogue are obtainable from Public Relations Department, Flexibox Limited, Nash Road, Trafford Park, Manchester, 17.

* * *

British Bitumen Emulsion's "Bitutherm" range has been formulated to meet the material needs of insulation contractors and consultants. The products in the range have all been proved in practice. However, many applications in insulation practice are unique to one particular project for which it is possible that the "Bitutherm" range does not contain the ready-made answer; when this occurs, the company invites clients to place the problem before their technical insulation department at their Slough works.

* * *

Chamberlain Industries Ltd., one of the Chamberlain Group of Companies announces that to supplement its well-known range of hydraulic pipe benders, it has accepted the sole distributorship for Great Britain and the Commonwealth of the Swedish manufactured Herber motorized tube bending machines for cold bending thin walled tubes and sections to small radii. These are marketed in two sizes, the model RBM-40 being suitable for steel tubes up to 1¼-in. diameter times 1/16-in. thick, and brass 2-in. diameter times 5/64-in thick, and the RBM-60 for steel tubes up to 2⅜-in. diameter times 1/16-in. thick, and brass 2⅞-in. diameter times 5/64-in. thick. A robust and generously dimensioned machine is the main essential for bending thin walled tubes and bearing this in mind, the machines have also been designed to ensure accuracy and speed. As standard, the machines are equipped for cold bending of thin walled tubes on the principle of the internal mandrel. The "Staffa-Herber" makes bending possible without filling material, and in spite of this the pipe retains its round section throughout the whole bending operation. Bending of rolled

COMMERCIAL AND INDUSTRIAL

FROZEN FOODS EXHIBITION

At the First National Frozen Food and Quick-Freezing Exhibition held in London last month, seven refrigeration firms were represented. A model self-service store was also exhibited (above right). On the left is seen the stand of Refrigeration Press Limited, on which "Frozen Foods," "Modern Refrigeration" and a full range of books were displayed.

sections can also be done with special tools. The " Staffa-Herber " is highly suitable for industries demanding high quality and great working efficiency.

* * *

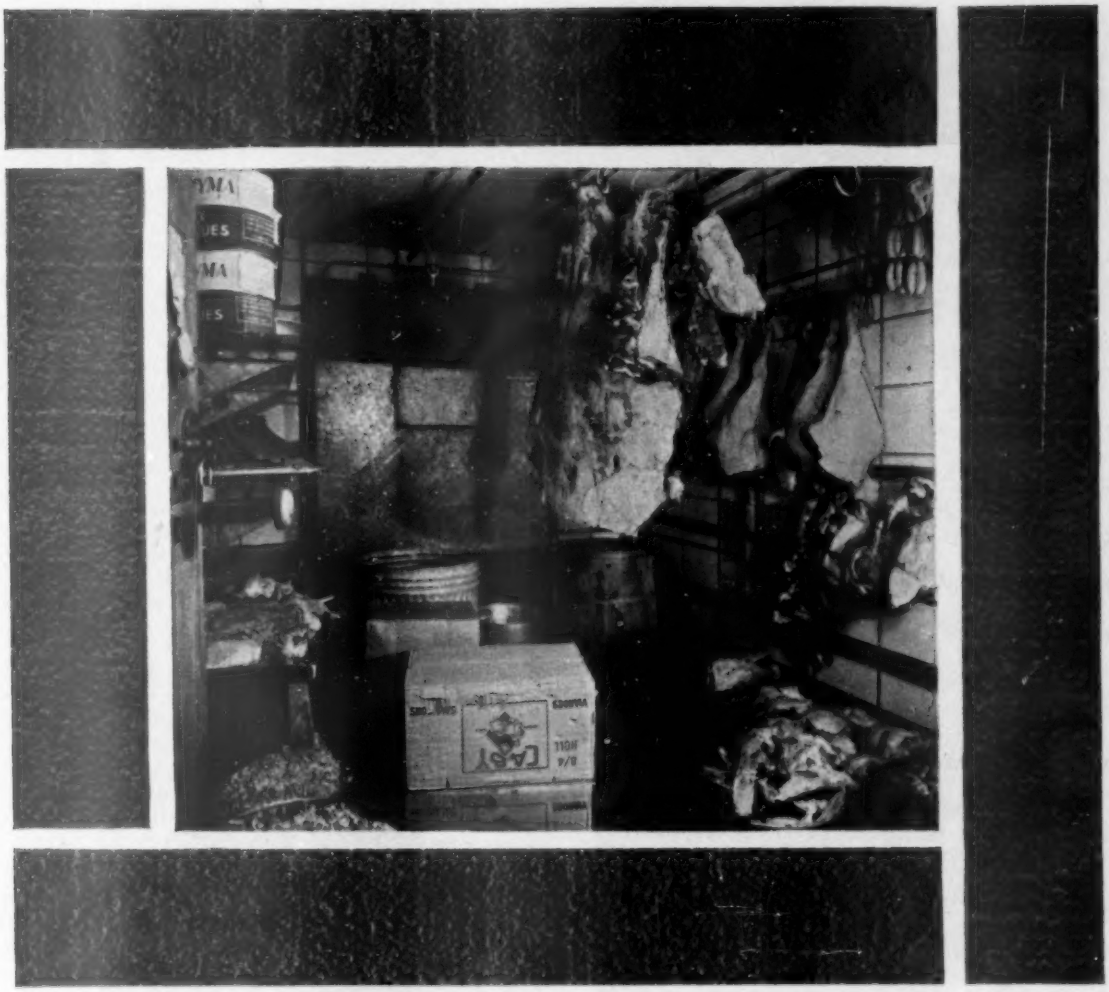
The Pressed Steel Co. Ltd. announces with pleasure that Mr. Robert N. Davies, works director at Cowley and chairman of the Motor Car Body Divisional Board has been appointed a local director of the company. Mr. Davies joined the Pressed Steel organization in 1926, shortly after its inception, as a foreman on the assembly lines, becoming a superintendent in the early 1930's. He was appointed to works management in February, 1952, and to the chairmanship of the Motor Body Divisional Board in December 1957.

* * *

An arrangement for common marketing of Hyster internal combustion engined trucks and Ransomes electric trucks is announced in Great Britain by **Hyster Ltd.**, Glasgow (Subsidiary of Hyster Company, Portland, Oregon, U.S.A.) and **Ransomes Sims & Jefferies Ltd.**, Ipswich. Basically the arrangement provides for Ransomes to be the sole manufacturers of electric trucks and Hyster to be sole manufacturers of internal combustion engined trucks, all for marketing exclusively by Hyster Ltd. Both companies will collaborate in design and engineering to the fullest extent. There is no financial link-up between the two companies. All distributors and dealers of both Hyster Limited and Ransomes Sims & Jefferies, Ltd., have been notified and as soon as possible the necessary adjustments to representation throughout the world markets will be completed. In the meantime existing arrangements continue for sales and service.

Refrigeration at Cologne Fair

The Linde exhibit of commercial and domestic refrigeration plant at the above fair in September.



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made from I.C.I. ISOCYANATES and POLYESTERS provide the refrigeration industry with an outstanding new material possessing excellent thermal insulating properties. Additionally they combine the advantage of great lightness with rigidity and strength. Polyurethane Rigid Foams can be made easily in a wide range of densities. The components can be conveniently mixed when and where needed and be simply poured or pumped into the desired position. The resulting foam can be relied on to withstand extreme cold and to resist heat.

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Ⓟ Patented in main industrial countries

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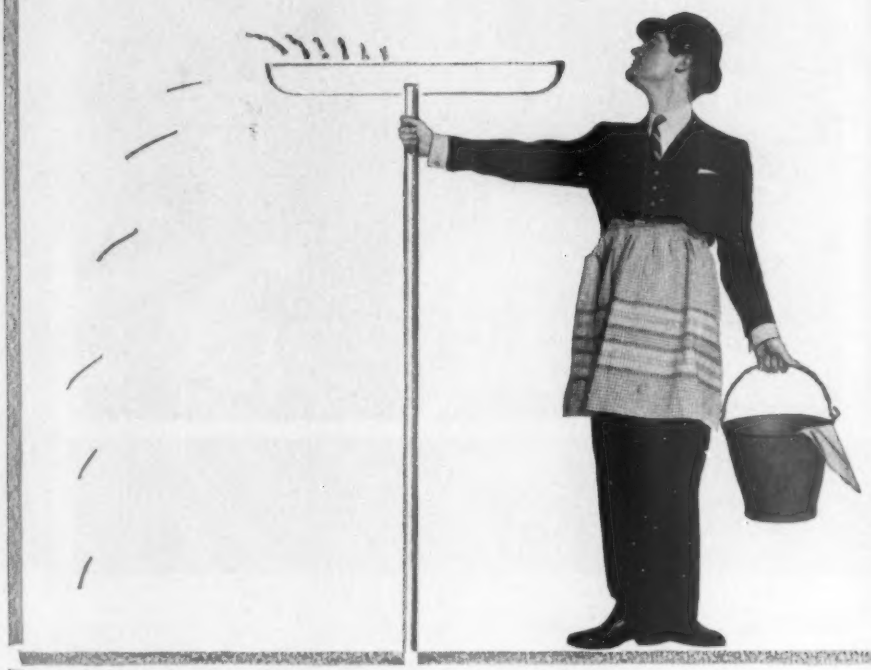

After a while, even the finest equipment begins to show its age.

When orders are coming in fast, and peak efficiency is vital—are you sure you're equipped to keep up with your competitors?

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UDT helps you replace old equipment, add new, out of income. Which often means it pays for itself out of increased profits.

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The Institute of Refrigeration Bulletin

Institute Headquarters: New Bridge Street House, New Bridge St., London, E.C.4 (CENtral 4694)

December Meeting

AT a joint meeting of the Institute and the Institute of Meat to be held on Thursday, December 3, 1959, at 5.30 p.m. in the Memorial Building of the Institute of Marine Engineers, 76 Mark Lane, London, E.C.3., Mr. F. R. I. Gerrard, M.B.E, member, and Mr. J. A. Stonebanks, member, will read papers on " The use of refrigeration in butchers' shops."

Mr. Gerrard's paper deals with some of the factors involved in the cold storage of meat in the retail butchers' cold store. Reference is made to the previous treatment of the meat and the difficulties of efficiently storing various meat commodities under similar storage conditions. Some of the more common faults frequently met with in retail cold storage are dealt with and recommended storage temperatures and times for fresh meat are given. A brief outline of the desirable conditions for the maturing of beef and the need for hygiene throughout is emphasized. The part of the refrigerating engineer in assisting with practical problems is stressed.

In his paper, Mr. Stonebanks will describe the various uses for refrigeration in retail butchers' shops of to-day. The temperature requirements for storage of town killed, imported, chilled and frozen meat and for the storage of frozen prepackaged meat cuts will be dealt with. Various types of refrigerated display fixtures including enclosed cases, refrigerated windows and open top sales cases will be described. Reference will be made to new developments in materials and finishes employed in the construction of cold rooms and other types of refrigerators now on the market. The paper will also make reference to refrigeration plant; in particular to forced air cooling units and automatic defrosting, also to air cooled and water cooled condensing units with open type belt driven compressors with direct driven semi-sealed and hermetically sealed compressors.

MEMBERSHIP

At the meeting of members held on September 1, 1959, the following were elected to membership of the Institute:—

Members

*Crowshaw, James, 64 Birtenshaw Crescent, Bromley Cross, nr. Bolton, Lancs.

*Lander, Arthur Valentine, Four Winds, Brookshill, Harrow Weald, Middlesex.

Scott, David Robert, 18 Church Rise, Forest Hill, London, S.E.23.

* Transfer from Associate Member.

Associate Members

Adlington, Ernest Albert, 6 Bingham Road, Frindsbury, Rochester, Kent.

†Dike, Nathaniel Akujuobi, Federal Ministry of Works and Surveys Headquarters, Lagos, Nigeria.

‡Freeman, Maurice Frederick, 8 Hillary Way, Wheatley, Oxford.

Hadrys, John Leslie, " Laurosa," Roserna Road, Canvey Island, Essex.

Haining, Peter Nelson, 16 Ravenscraig Road, Stewarton, Kilmarnock, Ayrshire.

Phillimore, Brian Arthur, " Wrekin," 5 Watling Street, Dartford, Kent.

†Russell, Derek, 28 Ingthorpe Avenue, Bispham, Blackpool.

Shone, Kenneth Arthur, 15 Mentmore Road, Liverpool, 18.

Slater, Robert Arthur Charles, 306 Hertford Road, Lower Edmonton, London, N.9.

†Sunder, Shiv, c/o Venesta Limited, P.O. Kamarhati, 24 Parganas, West Bengal, India.

Williamson, George Francis, 80 Rosegrove Lane, Burnley, Lancs.

† Transfer from Graduate.

‡ Transfer from Student.

Associates

Borrington, Stuart, 18 Borup Avenue, c/o Box 353, Kampala, Uganda, East Africa.

Bristowe, George Vincent, " Sunnyside," Chapel Road, Alphington, Exeter, Devon.

Brogden, Vivian, Sandhurst Corner, Little Common, Bexhill-on-Sea, Sussex.

Davey, Keith, 30 Hunt Road, Tonbridge, Kent.

Maycock, William George, Premier Development Co. Ltd., 725/730 Alexandra House, Hong Kong.

Sprange, Edmund A., c/o Marco Refrigerators Ltd., Manor Works, Streatham Vale, London, S.W.16.
Wild, George Edward, Weir Cottage, Weir Lane, Marshfield, Chippenham, Wiltshire.

Graduates

Blythe, David Jon, 240 Park Road, Peterborough, Northants.
Davies, George, "Silver Stream," Sprundel Avenue, Canvey Island, Essex.
Kilzi, Guy A., P.O. Box 1120, Beirut, Lebanon.
Kwok, Ping-Ki, 11 Staunton Street, 2nd Floor, Central, Hong Kong.
Mallick, Saeed A., A.C. & R. Division, Pasha Refrigeration Co., P.O. Box No. 2163, Kuwait, Arabian Gulf.
Perry, Thomas Nigel George, Coventry Farm House, Hankins Lane, Mill Hill, London, N.W.7.
Siddiqi, Aijaz Husain, 77 Plum Lane, London, S.E.18.
Singh, Bholanath, 4 Compton Terrace, London, N.1.
Virani, Sadruddin R., 44 Clauson Avenue, Greenford, Middlesex.
Welsh, Keith Lawson, 39 Fern Hill Road, Cowley, Oxford.

BRITISH STANDARDS

Electrical refrigerators and food freezers for household use (B.S. 922 & 1691 : 1959)

Two British standards for electric refrigerators and food freezers are now streamlined into one new and revised publication. They are B.S. 922 (requirements for all climates) and B.S. 1691 (for temperate climates only). Two upper limits of test temperature, 90° F. for temperate climates and 110° F. for all climates, are now specified in the combined version.

Up-to-date design practice and the latest refrigeration techniques are embodied in this revision ; refrigerators or food freezers built to its provisions should thus have a high standard of performance and be of consistant good quality. Advantage has also been taken in the revision to limit the permissible refrigerants to those known to be satisfactory and general use. Some alterations have been made to the methods of computation of shelf area and storage volumes.

Construction of both the cabinet and the refrigerating system is specified ; and detailed requirements for the electrical components are given. There are production tests for each appliance, as well as certain type tests for assessing performance.

Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 7s. 6d. (Postage will be charged extra to non-subscribers.)

Rating and testing of refrigeration compressors (B.S. 3122 : 1959)

This new publication relates to the methods whereby refrigeration compressors are rated for performance and tested for rating.

The standard specified and described four primary methods of test and five confirming tests which must be employed in assessing the performance of a compressor. The rating is taken as the performance during the selected primary test and is not published unless the selected confirming test falls within the allowable limits. Both tests are run concurrently.

The primary and secondary tests are required to be conducted under specified test conditions both inside and outside the compressor, and provisions are made to ensure that reproducibility of results is practicable. Standard methods for the determination of ratings will ensure that purchasers of compressors, particularly of those intended for the larger installations, have a satisfactory comparative basis for, say, the assessment of tenders.

The test conditions within the compressor are expected to be as near as practicable to those required by the selected group of application conditions, so that, when manufacturers publish their ratings under the terms of this standard, the purchaser will be provided with the information necessary to guide him in the selection of a compressor to meet his requirements.

B.S. 3122, Rating and testing of refrigeration compressors, may be obtained from the sales branch, British Standards Institution, 2, Park Street, London, W.1. Price 7s. 6d. (Postage will be charged extra to non-subscribers.)

BRITISH STANDARD FOR FERROUS AND NON-FERROUS BOURDON TUBING (B.S.3127 : 1959)

This new publication deals with ferrous and non-ferrous tubing supplied in straight lengths, in a suitable condition for the fabrication of the pressure-responsive components of gauges and instruments operating on the Bourdon principle. Requirements are specified for the following tubing materials :

Non-ferrous	Ferrous
Beryllium copper	Carbon steel
Brass	Chromium-molybdenum alloy steel
Nickel-copper-aluminium alloy	Iron base, nickel, chromium, titanium (precipitation hardening) alloy
Phosphor bronze	Stainless steel

Detailed chemical compositions are provided in respect of each of the above materials.

One section of the 24-page publication is devoted to requirements for a series of standard sections of " oval " tubing (together with appropriate tolerances). Requirements for sections other than these are required to be the subject of agreement between purchaser and manufacturer.

The standard's three appendices deal separately with : " Mercurous nitrate test on brass tubing," " Mechanical properties of cold drawn Bourdon tubing," and with " Guidance on microstructure."

Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. (Price 6s.)

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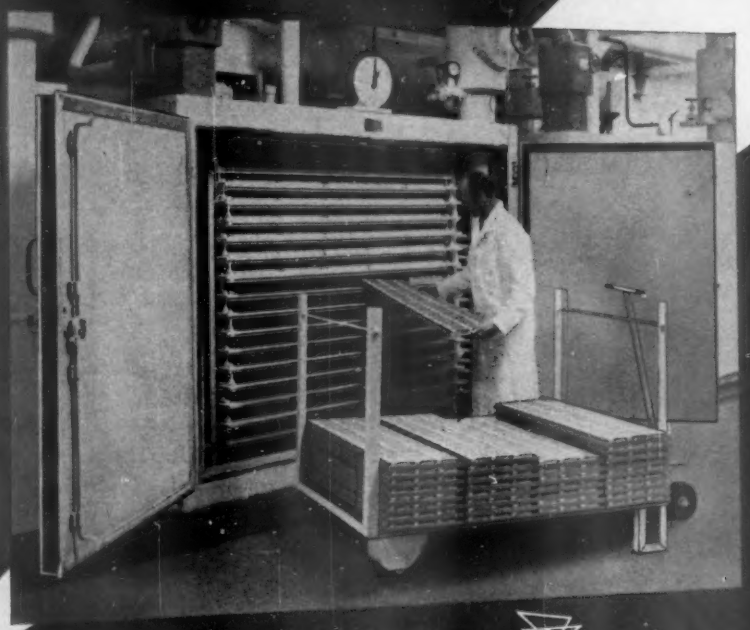

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SHOP REFRIGERATION NEWS

The Refrigerated Display of Normally Perishable Foods

Are Quick-Frozen Products an Incentive or a Deterrent to the Greater Use of Refrigerated Display for Normally Perishable Foods ?

By OUR RETAIL CORRESPONDENT

THE butcher, the baker, the candle. . . ; well no, make it confectioner, and you have the whole range of once improbable users of quick-frozen food cabinets. All three trades are additional to the originally and conventionally accepted stockists of quick-frozen foods : the grocer, the fruiterer, and the fishmonger.

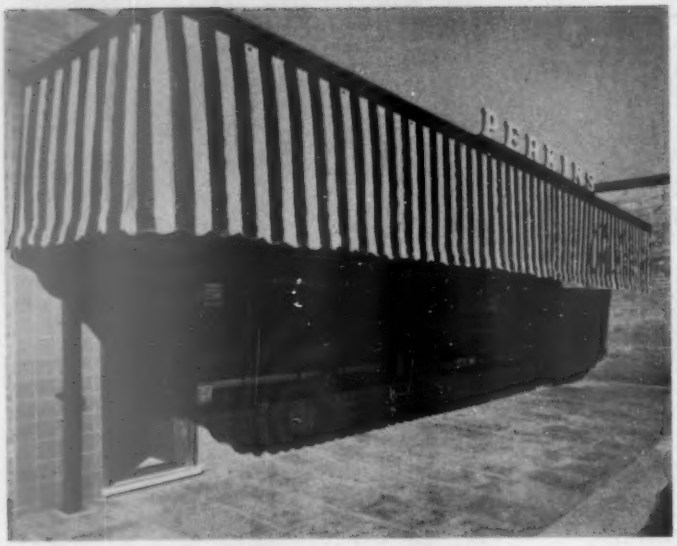
Are the first three mentioned, economically speaking, desirable stockists ? Or are they merely splitting up the market into a larger number of smaller outlets ?

That depends upon the merchandising policy of the retailers concerned. These three are as much entitled as the other three to sell quick-frozen foods. We have now got quick-frozen meat and meat products (butcher), quick-frozen puff-pastry (baker), quick-frozen pies, pasties, sausage-rolls, and sponge-sandwich (confectioner).

Fruiterers and fishmongers are selling all these more recently developed products, in addition to quick-frozen vegetables and fish, because, having invested in low-temperature cabinets, they sensibly regard them as frozen-food *departments*. The grocer, by virtue of the all-embracing nature of his business, includes *all* quick-frozen foods as a matter of course.

In Mr. Voss's shop at Wimbledon is the cooked foods and delicatessen cabinet, with housing for the condensing machine designed to match.

The logical procedure then is for the butcher, baker, and confectioner to follow the example of the fishmonger and fruiterer. That is to say, having acquired a low-temperature cabinet, to treat it as a department



The refrigerated displays in Mr. Eric Perkins's shop at Leicester are brought to the notice of customers by a refrigerated sign.

in its own right, and to carry a reasonably representative stock of everything quick-frozen.

There you have the present situation : every food retailer is already or potentially a stockist of quick-frozen foods. A small percentage only of the former, that is to say those now using low-temperature cabinets, are also employing other forms of refrigeration. Yet, having accepted those cabinets as necessary to an up-to-date business and, having become accustomed to the practice and advantages of displaying one class of merchandise under temperature-controlled conditions, all food retailers using frozen-food cabinets should, for that reason alone, be found more responsive than the non-user to suggestions for greater use of refrigeration.

That statement must be qualified : many small retailers will consider their limited capital resources are insufficient to permit purchase of a second cabinet. That is where another type of salesman can come on the scene, saying, " Don't buy it, hire it." It is only fair to mention here that the extended use of refrigeration by retailers has been in no small proportion brought about by the cabinet-hiring organizations.

To my mind, there are far too many representatives of makers and distributors of refrigerated cabinets who are, in effect, selling quick-frozen foods rather than refrigeration. A cabinet is essential for the sale of frozen foods, and, for a retailer to sell this class of merchandise is, so to speak, to be in the fashion. It is, therefore, quite natural, though short-sighted, for the cabinet salesman to take the line of least resistance by concentrating on selling the kind of refrigerated equipment that is most likely to meet with response, and which, by the same token, is less difficult to sell.

Sell Planned Refrigeration

A much broader-based system of sales-promotion is necessary to ensure sound development of the retail equipment section of the refrigeration industry. More information must be given to the food retailer about the economic, practical, and aesthetic advantages of temperature-controlled display. Silly generalities about the housewife insisting more and more upon hygienic conditions (when she is not doing anything of the sort : being, in fact, quite satisfied with reasonable standards of cleanliness in the shops she patronizes) should be replaced in both advertisements and selling talk by facts about what refrigeration does, how long a given product can be displayed under temperature-controlled conditions without deterioration ; by telling retailers what foods do *not* need refrigeration. (How very often one sees canned, bottled, and other products that have a long shelf life taking up valuable space in a refrigerated display cabinet.) To list the foods that do *not* need such protection is to underline, by implication, the importance of, indeed the imperative necessity for, maintenance of proper standards of protection—that is to say, refrigeration—for the others.

Contrary to the view held by many of the refrigeration equipment manufacturers, who tend to concentrate their sales-promotional activities on the multiple companies and large departmental food stores, it is still worth while going all out for the trade of the individual retailer.

I don't think it is possible to find a more convincing and heartening example of this fact—particularly in these days of supermarkets on the one hand and buying groups on the other—than the shop of Mr. A. B. Voss, F.G.I., who trades under the name Merton Provision Stores Ltd., at 137, Kingston Road, Wimbledon, London, S.W.19.

This shop is a superb example, too, of the way in which refrigerated display can help a retailer in a small way of business to keep up to date, and by that method to defy competition.

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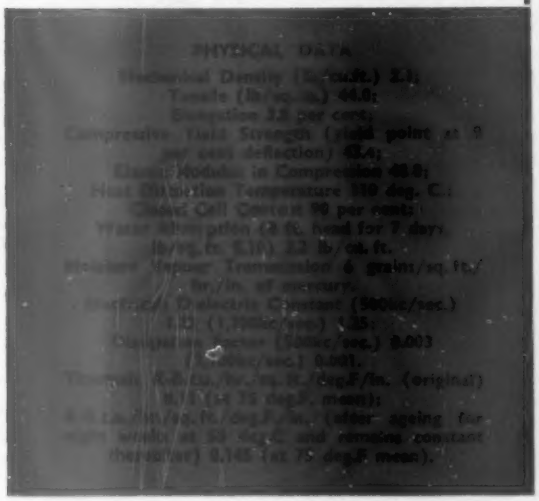

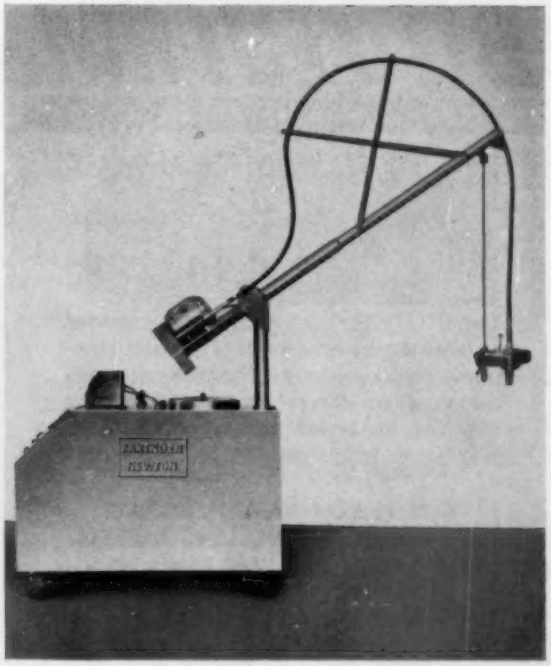

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2 F-22 standard/aircond. range (-22°F to 50°F in one valve) NOW NO EXTRA CHARGE.

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3 Bleed Valve AW-3H now available.

FLICA

4 Working demonstration of auxiliary controls will be included on Flica Stand No. 60 and RSL Stand No. 51 at Refrig. Exhibition London February 1960.

FLICA

5 Flica pioneered the non-corrosive needle and seat assembly—over a million now in use.

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6 Flica is the most inexpensive valve available —yet backed by the fullest guarantee of UNCONDITIONAL REPLACEMENT.

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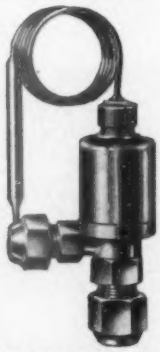
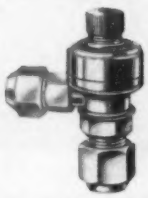


TW Thermo Exp. Valve universal F12/CH3Cl



AW Automatic Exp. Valve

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Mr. Voss has competition from a supermarket just round the corner and it does not worry him in the least. He carries on the business of a family grocer, even maintaining a delivery service over quite a wide area, and does not need the help of any voluntary buying group to enable him to run a very successful shop.

With interior trading space that measures only 18 ft. deep and 15 ft. wide, he has three refrigerated cabinets in active operation. One, for quick-frozen foods, 4 ft. long, and two others for provisions, dairy goods and delicatessen, each 6 ft. long, and all are Prestcold models.

It is a shop without counters, for the last two mentioned cabinets combine that function with the facilities they provide for glass-fronted refrigerated display. Another interesting feature of this installation is the manner in which the refrigerated machinery is housed. The casing made for this purpose is designed to conform to the shape of the cabinet and also provides a base for the Berkel slicing machine. Being near the shop door, where it is easily seen from outside, it even carries an advertisement for the bacon of which the shop makes a speciality.

This shop is, however, not unique in this respect. In the shop of Mr. J. I. Heald at Fleetwood, Lancs., there are two refrigerated cabinets at one end of each which is a case for the condensing machinery designed exactly to conform to the height and shape of the counter-type cabinets. Their top surfaces are used for display and there are three display shelves in front. The cabinets, and also an 8-ft.-long low-temperature

The Iwo cabinet in the same shop at Leicester.

model for frozen foods (all three Yorks), were supplied by The Refrigerator Depot of St. Annes-on-Sea, York Shipley distributors for the district.

There is an unusually attractive food shop in Leicester belonging to Mr. Eric Perkins, who considers it important to let the public know that his more perishable stock is displayed under temperature-controlled conditions. He has an illuminated sign in the window carrying the words" refrigerated displays," and wet fish is displayed on a glass-screen-fronted refrigerated slab set back slightly from the window and set at an angle in the shop and easily seen through the window there is one of the latest types of Swedish

Pioneer of a new development.

low-temperature cabinets for quick-frozen foods. This is an Iwo, for whom the distributors in this country are M. L. Winsor & Co. Ltd. All the refrigeration in this store was carried out by the Refrigeration Division of The Midland Dynamo Co. Ltd., Leicester.

A new development by Frigidaire—a 5-ft.-7-in.-high cabinet for dairy goods, provisions, and the like—seems to portend a rise in the level at which foods can be displayed under refrigerated conditions. This will be a particularly desirable development for self-service shops, and if it proves a practical proposition to apply it to quick-frozen food cabinets it will be particularly welcome.

NEW MAC FISHERIES' STORE SELLS WRAPPED FROZEN FISH

A NEW Mac Fisheries' self-service store—a store with a difference—was opened at Slough recently.

The difference mentioned above is that the new branch sells fish only in frozen form. Commenting on the opening of the new branch, Mr. Derek Nunn, Mac Fisheries' marketing director, said : " Sales figures for the new branch indicate that this bold experiment in fish selling has started well. Shoppers

have been quick to appreciate the advantages of wrapped, frozen fish. We are constantly seeking new ways of furthering our aim of maximum service and convenience for the shopper. The new store conforms to that aim."

Shoppers at the new store could buy frozen fish at prices appreciably lower than the branded fresh-frozen product, and in a wide range of familiar cuts. Fish is packed in hygienic transparent packs, each marked with the exact price and weight. Over 30 varieties of fish are packed in this way. Complete freshness is assured because fish is cut, packed, and frozen immediately after landing at the ports. Still in its frozen form, it is displayed in refrigerated cabinets in the shop until sold.

Each cut is wrapped in a hygienic transparent wrapper, so that it is not only completely protected, but is unlikely to impart a fishy smell to the other contents of the shopper's basket. As each cut is fully visible through the transparent wrapper and marked with price and weight, the shopper can select the right cut at the required price. Moreover, there is no waste.

While specializing in frozen fish, the new branch also sells poultry, cooked meats, a selection of ready-cooked fish, and a wide range of groceries and provisions.

Setting for this experiment in fish selling is modern, attractive and colourful. The wall facing the entrance is covered in a restful, grey, contemporary patterned texturide, while side walls carry a white scattered pattern. The 400 sq. ft. selling area is covered with lino tiles in a random design of white-grey stone, pigeon, royal red and blue.

Miniveil at Sea

THE uses of the modern Miniveil air curtains are wide and varied and many problems are now posed that were not originally envisaged. Such in fact was the case of the new 31,000 tanker *Caltex Cardiff*, the latest unit in the Caltex fleet.

The meat room has to be reached via a handling room and very small air lock ; within the meat room is a separate deep freeze, and adjoining the meat room there are vegetable rooms and dry stores.

Apart from a considerable temperature rise in the meat room if the doors were open, there was found to be the problem of operating the doors in such a confined space when provisioning. The ideal place to install the Miniveil, as far as the meat room was concerned was, of course, within the air lock, but this would have interfered with the easy handling of the vegetable room doors. Also the meat room fan which is located just inside the door, created considerable turbulence and ingress of outside air. After examination and test of air flows, it was decided to fit the small Miniveil immediately outside the air lock in the handling room. The Miniveil was designed to be very flexible in operation and to achieve a wide measure of control over a varying number of conditions. When the Miniveil had been installed loading time was reduced to one-fifth as it was then possible to leave all doors open without any appreciable rise in temperature. Due to the very good summer, tests were possible that are not usual in this country, and on the day of test, the temperature immediately outside the vessel was over 80° F. The temperature within the handling room exceeded 70° F. With the Miniveil switched off and the meat room door open for 30 minutes there was a temperature rise of some 35°. When the meat room temperature had gone back to normal, the Miniveil was switched on and the door was left open and the temperature rise after 40 mins. was only $1\frac{1}{2}°$.

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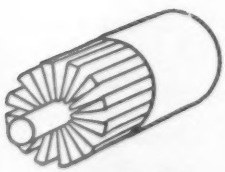
Heat-X CH inner-fin water Chillers range from 2 to 100 tons capacity. With non-ferrous water passages throughout there are no corrosion problems and single pass construction prevents oil-trapping.

Details of construction, specification and dimensions are available. Please write for Bulletin HX/1001A.



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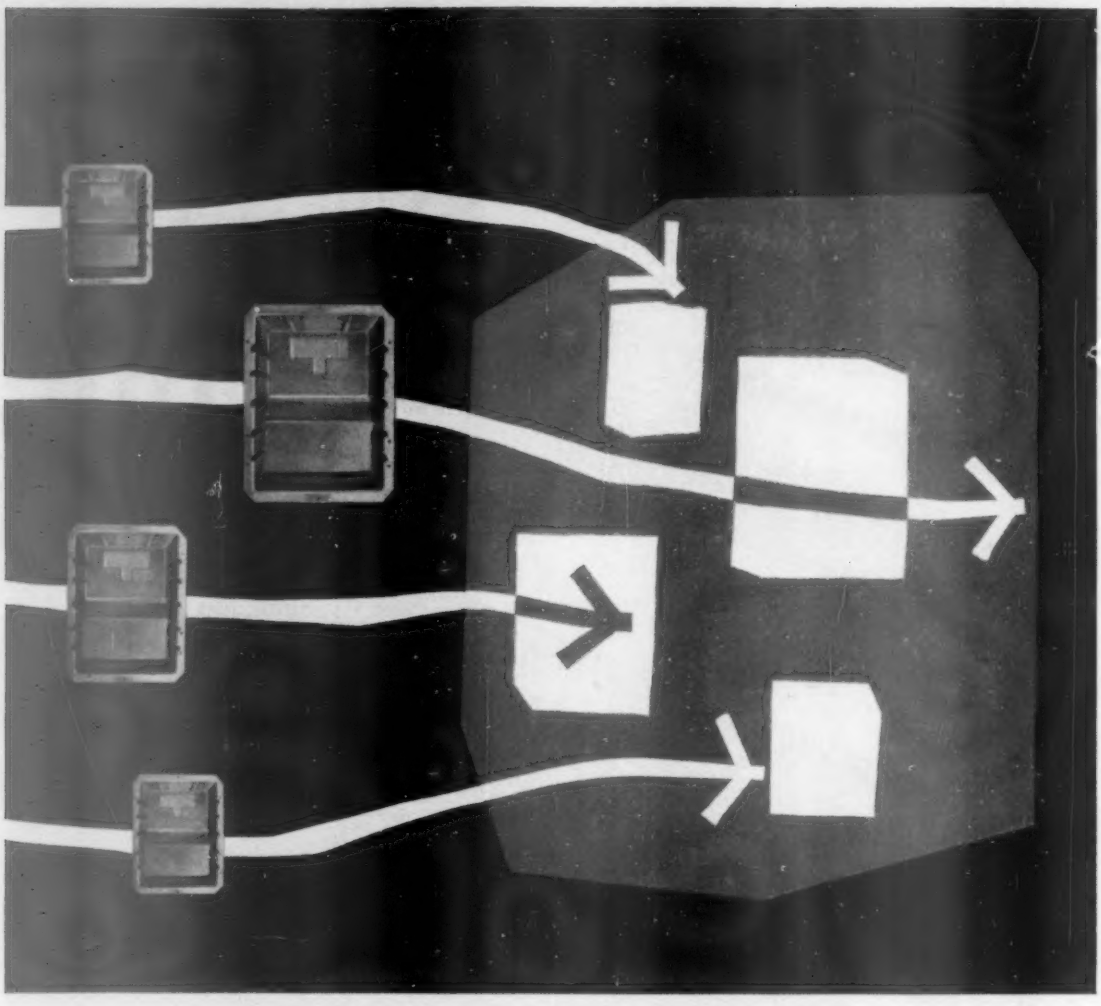

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13 million refrigerator liners are required before Britain enjoys the same standard of domestic refrigeration as America.

IRIDON are geared to meet the demand which must come. Already, two-thirds of all British refrigerators have liners of rapidly-formed Iridon H.I.P.S. With this high-impact polystyrene sheet, manufacturers find that half the work is already done.

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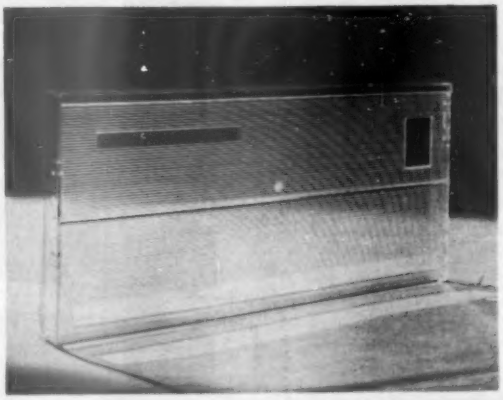

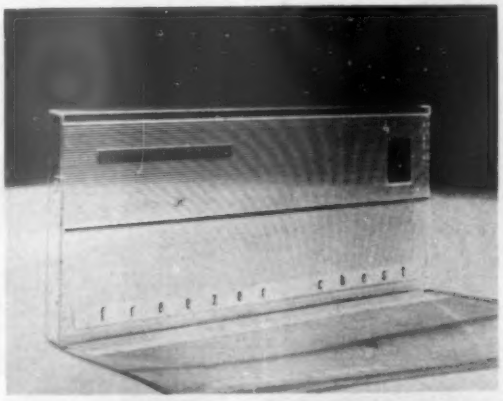

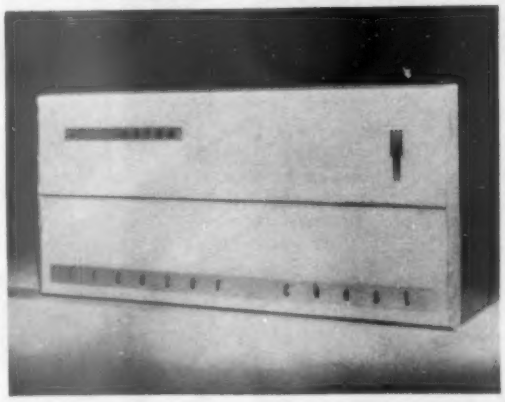

Top: Basis moulding in transparent polystyrene of freezer chest door.
Centre: Lettering and design motif added to transparent moulding by hot-stamping process.
Lower: The reverse side of the freezer door is sprayed in two colours to complete the styling treatment.

WITH the increasing use of plastics mouldings in refrigerators, attractive styling becomes an easier and more economical proposition quite apart from other advantages of plastics such as freedom from corrosion, ease of cleaning, etc.

Polystyrene, with its good mechanical properties and excellent appearance, is used extensively for such items as freezer chest doors, drip trays, butter compartments, name badges, control knobs, etc., as well as door liners and complete tank liners.

Although tank liners and door liners are frequently formed from sheet material with the advantage of lower tool costs at the expense of slower production, most other items must be moulded to achieve the required shapes. Recently Ekco Plastics Ltd., installed the first machine of its kind in this country to produce moulded tank liners in order to escape the design limitations imposed by sheet-forming techniques.

From the economic viewpoint, moulded components need to be produced in fairly large quantities in order to absorb the comparatively large tooling cost. In fact, most tools can be used almost indefinitely if they are suitably made and this makes it an economical proposition to avoid changes in design of individual components for as long as possible. On the other hand, periodic changes in styling are considered necessary to maintain sales figures and for this reason, expensive moulds are frequently superseded by replacements of similar basic design but aimed at different styling detail.

Considerable changes in appearance of such items as freezer doors, etc., can be achieved merely by altering the style and position of wording, design motifs, etc., without altering the basic shape of the component. It is quite usual nowadays for certain items to be moulded in transparent material with lettering and other designs moulded on the reverse side in relief. This allows the use of colour filling followed by spray painting in one or more background colours, also on the reverse side. This method permits the full use of colour and design while preserving the advantage of a smooth, easy-to-clean plastics surface. However, the extent to which the appearance can be altered, without altering the mould, is limited by the fact that the lettering and design are incorporated in the tool.

A recent innovation in the refrigerator field is the use of hot-stamping on a finished moulding to produce the required styling treatment. Using this method, a control knob, for instance, can be moulded without any markings and subsequently hot stamped to produce calibration figures, design motifs, etc., as required for a number of different applications.

Hot stamping involves the release of metal or pigment from a specially prepared foil and its trans-

continued on p. 1010

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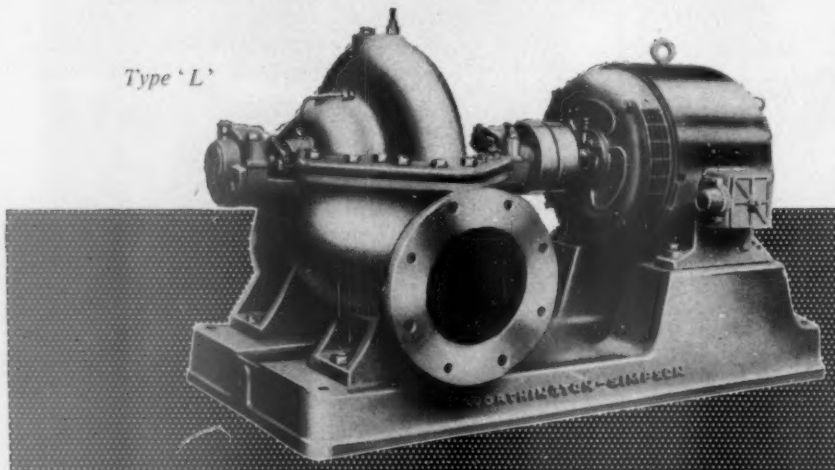
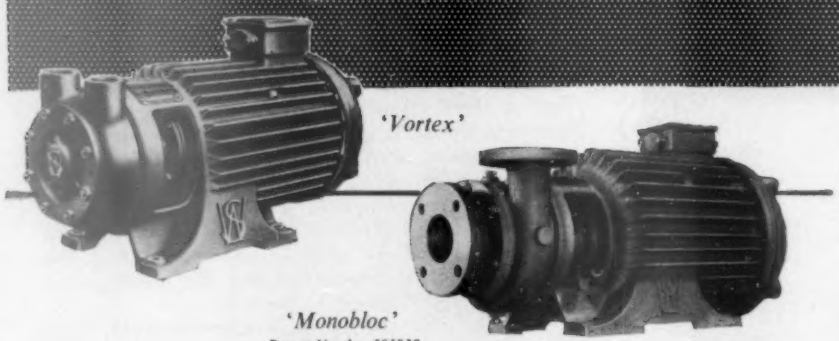
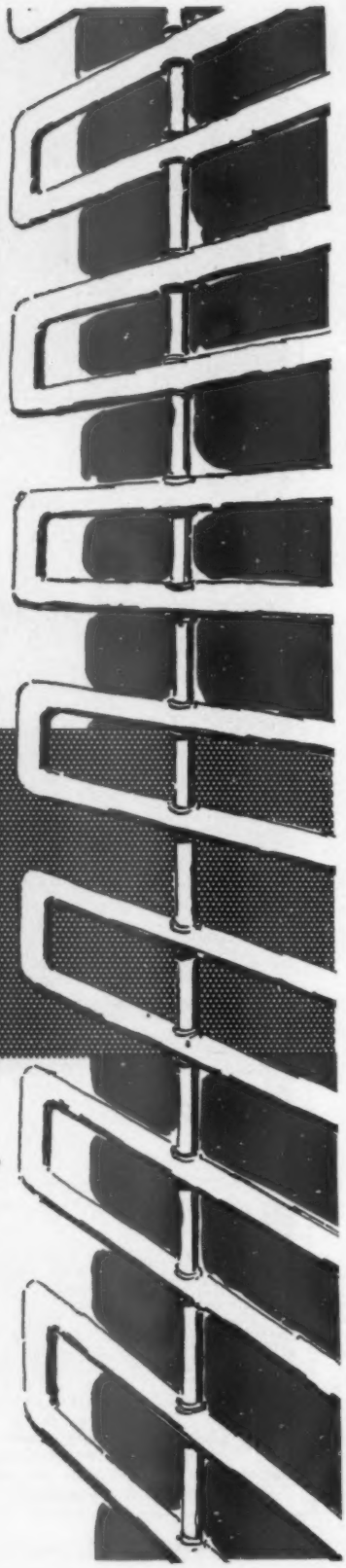


'Vortex'



'Monobloc'

Patent Number 591835



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NEWARK NOTTS

Refrigeration Patents

These new refrigerating patents have been specially selected for readers by MODERN REFRIGERATION from the official "Journal of Patents," and are published by permission of the Controller of H.M. Stationery Office.

APPLICATIONS RECEIVED

September 14—Heron, A. G., P31326, Refrigerating apparatus. 15—General Motors Corporation, C31394, Refrigerator, C31396, Refrigerators. 16—Grimmett, G. J., P31543, Refrigerator. 21—Robertson Thain Ltd. (Robertson Co., H. H.), C32063, Air-conditioning systems. 24—Whirlpool Corporation, C32544, Refrigerators; Carrier Engineering Co. Ltd., Bradshaw, N. F., and Keble-White, A. J., P32572, Air-conditioning.

COMPLETE SPECIFICATIONS ACCEPTED

October 7—Morris, A. S., 824,676, Thermally insulated containers; Frigeco, S. A., 824,608, Refrigerator apparatus; General Motors Corporation, 824,632, Refrigerators, particularly refrigerant passage connector assemblies. 14—Soc. Francaise Autofrigor, 824,888, Refrigerated cabinets.

Optimum Conditions for Fresh Food Preservation in the Domestic Refrigerator

By E. W. ZEARFOSS and F. P. SPEICHER*

Positioning the sealed compartment below a higher temperature region reverses the direction of heat flow through the compartment top surface. This arrangement, by increasing the top surface temperature, curtails the development of convection currents and obviates moisture accumulation and drippage to the compartment contents.

Any condensation on this surface during usage of the compartment facility will subsequently migrate to cooler wall surfaces within the compartment. Moisture on these surfaces presents no drippage problem.

Temperatures in the 36° to 40° F. range are necessary for acceptable natural or cyclic defrost of the evaporator in the fresh food section of the cabinet. This higher temperature zone, external to the sealed compartment, fortunately coincides with the needs of other groups of foodstuffs, and can be compartmented for utility and styling or left with open shelves. These regions will provide satisfactory storage for canned foods, bottled goods and beverages, dairy products and other foods not readily desiccated or deteriorated by higher temperatures.

* *F. P. Speicher is a Biologist and E. W. Zearfoss is development engineer, advanced development dept., appliance engineering, Philco Corporation. This paper was presented at the Domestic Refrigerator Engineering Conference, at the ASHRAE annual meeting, Lake Placid, N.Y.*

Conclusion

Actual food preservation tests were conducted on a refrigerator equipped with a special compartment designed to provide optimum storage conditions. The compartment was loaded with a cross-section of foods especially responsive to temperature and humidity. These included, all uncovered: Meats—chicken, pork chops, hamburger, steak and lunch meats; Vegetables—celery, lettuce, tomatoes, parsley; Leftovers—mashed potatoes, whipped cream, a sandwich, sliced tomatoes and chocolate pudding. Using a group of current model refrigerators on the domestic market, similar foods were placed in the recommended storage region or facility. Observations were made on all foods every day by a test panel that included a home economist.

The optimum temperature and humidity air-wrapped compartment provided excellent preservation of all food specimens, both from a quality and a time duration standpoint. These tests confirmed the premise that a near-freezing temperature, a high humidity and still air are optimum for fresh food preservation.

The authors express their appreciation to Lloyd A. Staebler, manager, advanced development, for his guidance and encouragement in the preparation of this paper, and to Adelaide Fellows, director, Home Economics, for her help in conducting and evaluating the food load tests.

OBITUARY

Mr. John Kilgour

We much regret to have to record the passing of Mr. John Kilgour (New Standard Cold Storage (Aberdeen) Limited.) Mr. Kilgour took a leading part in the formation of the Scottish Association of Cold Storage & Ice Trades in 1940 and was its president for the greater part of the difficult war period. In addition Mr. Kilgour served for many years on the committee and his wise counsel and enthusiasm for the Association and all its affairs will be greatly missed.

The late Mr. Kilgour was to have been appointed honorary president of the Association at the 11th annual general meeting of members held this summer and his outstanding services to it were to have been recognized in tangible form by the presentation to him of a silver salver on which the names of his many friends in the Association are engraved and by whom he is deeply mourned.

Bulletin of the International Institute of Refrigeration No. 4 Volume 39 1959

Reviewed by DR. EZER GRIFFITHS, *Hon. President of the Institute*

FIVE pages of the *Bulletin* summarize the titles of some of the topics which came up for discussion at the 10th International Congress. About 330 papers were presented and the nine Commissions held 60 working sessions.

Reviewing recent meetings and congresses we learn from the *Bulletin* that a technical refrigeration meeting was held at Weimar in February 1959 at which the subjects included mass production of small refrigerators, automatic control in large ammonia and "Freon" plants, turbo compressors, refrigerated railway vehicles, low pressure plants for the production of oxygen and plants for temperature fields down to –100° C.

It is the practice to give in the *Bulletin* information as to the current research programmes in various laboratories. In Australia work is being carried out on drip from frozen meat, controlled atmosphere storage of apples and scald. Attention is being directed to hygrometry, to the heat pump and to the thermal transducer. In the programme of the National Bureau of Standards U.S.A. it is stated that in 1958 2,500 litres of liquid helium were produced and nearly 200,000 litres of 90 to 95 per cent. parahydrogen.

The Refrigeration Research Foundation sponsor research in various centres in the U.S.A., amongst the items cited are refrigerated storage of nursery stock, ornamental plant materials, evaporated milk, nuts and nut products, freezing of oysters, etc.

The National Engineering Laboratory, East Kilbride, Scotland, has on hand a number of investigations of interest to the refrigeration industry. These include tabulation of thermodynamic properties of fluids and development of promoters for dropwise condensation of refrigerants.

A brief reference only can be given to the 228 abstracts contained in the *Bulletin*. Several relate to temperature measurements and include platinum resistance thermometers, gallium arsenide, carbon thermometers and thermistors.

Numerous abstracts are included under the heading "heat transmission" one of them dealing with a 181-page dissertation on "Formation of ice and heat transfer along the circumference of a circular cylinder in a humid air cross flow," another on "Apparent coefficient of transmission of pipes equipped with longitudinal fins."

A paper entitled "Data for the design of refrigeration plants" describes the development of standardization in Czechoslovakia and cites the basic standards of that country.

A paper from the U.S.S.R. discusses the properties of "Freon-30"; it is stated that the use of this agent leads to marked decrease in the required heat transmitting surface.

Another abstract states that n-perfluorbutane could be used in a single-stage, centrifugal compressor.

A paper published in the U.S.A. states that "Better standards are needed for refrigeration lubricants" and stresses the need for simple short time comparative tests.

Two abstracts deal with "Methods of testing for rating compressors and condensing units."

A number of abstracts are included under the heading refrigeration equipment working on other systems than mechanical compression. Some of the titles are, "Cooling systems based on solar regeneration," "Theory of thermoelectric cooling and electronic refrigeration," the last mentioned refers to a bottle cooler-warmer utilizing the Peltier Effect.

In the section dealing with auxiliary equipment there is a paper on "Recirculation" from the Cooling Tower Institute, U.S.A.

A few abstracts relate to insulation. It is stated that Iporka-K plates are made of expanded synthetic resin, coated with bitumen reinforced with glass fibre, this layer having holes on the side exposed to the higher water vapour pressure. Concrete foam insulation is mounted on a bitumen rather than cement layer to eliminate seasonal migration of moisture.

One abstract is entitled "Simplified calculation of water vapour diffusion in compound walls with accumulation of water and ice."

Abstracts dealing with large installations cover British, Spanish, and Italian constructions. A Canadian publication deals with the "Construction and operation of a household cold store for fruit and vegetables," whilst a U.S.S.R. paper is entitled "The testing of an automatic 'Freon' plant with direct cooling of several rooms." From the same country comes a paper on "Tests on a plant for deep-freezing."

Air-conditioning and heat pumps are well covered in the abstracts. Some of the titles are, "The use of refrigerating machines in air-conditioning for the cooling of air," "Plate coolers vs. humid air coolers in air conditioning plants," "How to select and specify air heating and cooling coils" "Air-conditioning in photo-engraving workshops," "Heat pump enters automotive air conditioning," "Practical results and comments about some air-conditioning plants on board liners."

There are a few abstracts relating to ice one "Problems of ice cube makers." It is stated that 43,000 automatic ice cube makers were sold in 1957.

Refrigerated transport by rail and road is dealt with in several abstracts. There is a description of two test stations for insulated trucks. A paper from South Africa deals theoretically with the problem of containers for transporting fresh fish in ice. Another paper from the U.S.A. considers methods and equipment for ice-packing poultry.

Papers bearing on the gas liquefying industry include one dealing with possible explosion due to hydrocarbons in liquefied gases extracted from the air.

The section on "Building and civil engineering" contains several abstracts relating to skating rinks and one on "Results of a study of the thermal properties of frozen soils."

The section on refrigeration as regards plants and food products contains a lengthy abstract entitled "Sanitation code for frozen foods."

The cooling of fruit is the subject matter for several abstracts; one dealing with the engineering aspects, another with possible improvements and a third with packaging of apples in plastic bags.

"Modern methods for the storage and preservation of vegetables under refrigeration" deals with the possibilities of irradiation among other topics.

The section of the *Bulletin* devoted to animal products has a lengthy abstract entitled "Some aspects of hygiene in the cold storage and transport of animal products." An abstract entitled "Quick cooling of meat" is based on the Proceedings of the 2nd International Congress of Directors of Slaughterhouses.

Two abstracts deal with poultry tenderness and take up two pages of the *Bulletin*.

Many abstracts concern dairy products: cooling and freezing butter, surface deterioration of cold stored butter, and loss of certain acidic compounds during the frozen storage of cheese.

The *Bulletin* contains a 7-page report on refrigeration education within the United States.

In the list of new publications received at the Institute there is a report of 101 pages on the First Australian Refrigeration and Air-Conditioning Convention held in 1958. The Greek Ministry of Agriculture has issued vol. 2 of a report on their refrigeration industry.

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BOOK REVIEW

SORPTIONS-KAELTEMASCHINEN (Absorption Refrigerating Machines). By DR.-ING. WILHELM NIEBERGALL. 568 pp. large octavo with 258 illustrations and five charts in pocket. DM.96. Springer 1959.

This is the 7th of the 12 volumes being prepared as the German Handbook of Refrigeration under the general editorship of Professor Plank.

The theory and practice of absorption refrigeration are comprehensively treated in this book written by a professor at the Berlin Technical University. It deals with fundamental thermodynamic principles of binary mixtures in normal and reversible absorption and resorption machines for single and multi-stage working, with heat balance and analyses of the various ideal processes. One chapter gives a review of the various pairs of substances employed as solutes and solvents.

Cycles of operation are worked out with the aid of the log $p/\frac{1}{T}$ and enthalpy-concentration diagrams for both ideal and practical working processes, with analyses of the weaknesses and losses of the latter.

Separate sections are devoted to small and industrial types of plant. The former includes the theory of the continuous type with inert gas and thermosyphon pump, together with test results of various types. Industrial types are comprehensively treated in about 200 pages devoted to study of their construction, functioning, control and application.

An Outline of New Zealand Procedure and Practice in the Technical Training of Refrigeration Engineers

By J. L. GICHARD, M.I.MECH.E.

*President, N.Z. Institute of Refrigeration Engineers (Inc.)**

NEW Zealand has a very positive approach to the control and training of persons contracting to serve an employer and to learn and be taught any industry. "The Apprentices Act" has, as a controlling authority, "The Court of Arbitration." Where any group including either employer or worker consider that they are entitled to avail themselves of the provisions of this act, they make application to the court, or to the official appointed under the act, "The Commissioner of Apprenticeships" to register an agreement to set up an apprenticeship committee to deal with it. In due course an "order" is made by the court, which covers the list of "skills" to be taught, hours of work, and the technical training and period of apprenticeship, etc.

Although refrigeration engineering has been accepted and practised for many years, no provision was made to train apprentices in it, except in general terms of "The New Zealand Engineering Industry Order." The rapid development of domestic, commercial and light industrial refrigeration in the late 1920's revealed that there was a definite shortage of staff competently trained to erect, install, maintain and service refrigerating apparatus. So a move was made under the above "Act" to get a "Refrigeration Engineering Industry Apprenticeship Order" and this was successful.

It was subsequently found necessary to enlarge the scope of the list of "skills" and a limited list of "skills" in "electricity" was added to enable a serviceman to give full service to the industry. The regulations of the electrical industry prohibit any person from doing any work on electrical apparatus unless they have a "licence" to do so.

Due to the close inter-relation of mechanical and electrical maintenance in modern refrigeration apparatus, it was essential that refrigeration engineers be permitted to maintain the electrical side as well as the mechanical side. To enable this to be done an amendment to the "electrical industry regulations" was obtained and competent refrigeration engineers are, after passing both a practice and theory examination, granted a "limited licence" to do this electrical work and maintenance. An apprentice is now required to serve 2,000 hours of the 10,000-hour apprenticeship on electrical equipment under the guidance of a person holding this "limited licence" to complete his apprenticeship.

So an apprentice order is now granted to refrigeration engineering with both mechanical and electrical skills, covering all that is required to complete an apprenticeship over the whole installation and servicing of refrigeration plant and to enable an apprentice to become a practical refrigerating engineer.

The above sets out the practical side of his training. On the technical side, the N.Z. laws require the Department of Education to set up classes for the technical education of apprentices. He is required to attend these classes and eventually under the Trades Certification Act he can pass examinations set up and receive a certificate indicating his practical ability and technical knowledge. Under some circumstances and to provide correct and positive instructions, apprentices are brought to a central training college, where the required apparatus and plant are set up. They are put through a period of concentrated training at this centre to complete their apprenticeship. Attendance at technical classes and at the training college is compulsory as part of the apprenticeship. The courses are based on The City & Guilds of London "72 Refrigeration" amended to suit the particular requirements of our national development. This is the set up for the supply, training and education of refrigeration service engineers in New Zealand.

It was found that apprenticeship training as above, sufficient to provide efficient service to the public generally, did not meet our full national requirements. It did not measure up to the knowledge required for the design, installation and operation of large installations, such as are required in meat works, cold stores, etc. For this work it was found that a much greater knowledge of the science and technology of refrigeration was required. To provide for this the Dept. of Education, in conjunction with the N.Z. Institute of Refrigeration Engineers, drafted two syllabuses to be taken voluntarily by students under a system of technical education known as "The New Zealand Certificate in Engineering." These courses are set up for students in civil, mechanical, electrical and refrigeration engineering. The certificate is granted on completion of a five year course and on passing the examination required. Under this, the above branches of engineering are all given the same status and recognition.

The basic course consists of two years in the same course in mathematics, drawing, science etc. After this each branch goes into its own courses for completion.

* *Specially contributed to "M.R."*

In refrigeration there are two syllabuses. One is a four-year course, on completion of which the pass is recognized by a technical training certificate. This course is an extension on completion of the "72 Refrigeration" course taught in the apprenticeship stage. The full five-year course is based on "Refrigeration 73" of the City and Guilds of London syllabus, with further additions and amendments to suit our national requirements. Passes are recognized by "The New Zealand certificate in engineering (refrigeration)" and the certificate is issued under an act known as The Technicians Certification Act and so becomes a legal title, to be used only by those who acquire it. Thus a student is rewarded for his industry and is given recognition and official status.

It is further hoped to have a bill passed through the N.Z. Parliament that will enable those acquiring the certificate to become registered with the exclusive right to certain titles and terms to indicate to the public their ability and status.

In all the above the New Zealand Institute of Refrigeration Engineers has played a prominent part. It initiated all the steps for apprenticeship and for the electrical legislation and examinations and for the apprenticeship training. Carrying on, it co-operated with the Department of Education in the drawing up of both the technical and The N.Z. Certificate in Engineering (Refrigeration) syllabus. It continues to play a big part in all these matters and is the body to which all references are made. By its initiative it has brought refrigeration engineering in New Zealand industry from chaos into a well regulated and recognized industry of high standing, meeting the requirements of this country. Also in giving its members recognition and status in the community as participants in this industry, capable of giving it the necessary knowledge and skill required to enable it to function in the highly important part it plays in the national economy of this country, which depends on exports under refrigeration for approximately 45 per cent. of its overseas income to maintain this national economy.

Its efforts have not stopped in New Zealand. It is apparent to all that there is only one basic training for a Refrigeration Engineer. He is a specialist in his branch and so he must be trained for it.

The N.Z. Institute of Refrigeration Engineers found that the foundation for that training was well laid by the City and Guilds of London in syllabuses 72 and 73. Those responsible for these two syllabuses have done very good work indeed. The N.Z. Institute accepted this syllabus as the basic requirements, modified only by the national requirements of the industry in N.Z. Having drawn up their syllabus on the basis of 72 and 73, it was sent then, together with all other relevant matter to the following :—

(1) The Institute of Refrigeration, Great Britain.
(2) The Indian Society of Refrigerating Engineers.
(3) The South African Institute of Refrigeration.
(4) The branches of the Australian Institute of Refrigeration in New South Wales, Victoria, Queensland, West Australia, South Australia and their head office.

This was done with a suggestion that all the above nations base their syllabus on the same original, with only such modification to suit their national requirements, so that we would then have a Commonwealth standard basic training similar to that which the major Institutions of engineering, civil, mechanical and electrical have now in use and practice.

By this we would have free exchange of engineers between our different nations, but all with the same basic recognized training and attainments and acceptable in whatever country he decided to live in.

CONSTITUTION OF THE N.Z. INSTITUTE OF REFRIGERATION ENGINEERS

As New Zealand is not a large country, it was recognized at the founding of the Institute that it would be better to have one Institute to embrace all grades of refrigerating engineers. So grades were set up as follows :—

Students :	For apprentices and students.
Service :	For those engaged in domestic and commercial work at large.
Operative :	For those who operate large industrial plants.
Associate Member :	Corporate member of the Institute.
Member :	Full corporate member.
Associates :	Non-practising, but with scientific or similar interest in refrigeration.
Affiliates :	Indeterminate grade, not practical, but profitably engaged in the Industry.
Hon. Members :	Those retired, or whom the Institute desires to honour.

It has been found that the above gradings are very advisable; since its founding many members have advanced in the profession up to the highest positions of control and responsibility through the lower grades and have been given the appropriate grade accordingly in the Institute. The Institute has found it can better serve all grades by this, than by having separate bodies representing grades with varying knowledge and degree of responsibility in the industry.

GILDING THE FRIDGE

Continued from page 1003

fer, by means of a heated printing block, on to the plastics material, to which it adheres through the activation of a heat-sensitive adhesive. The cost of the required printing block or blocks is small by comparison with that of a plastic mould so that a complete restyling of a basic component becomes an economical proposition.

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It will be seen from the illustrations that this particular component has not been designed with a view to ringing the changes in styling as the moulding itself is styled to suit the finishing treatment. In this case the hot stamping process stands on its own merit as an attractive styling medium for plastics mouldings.

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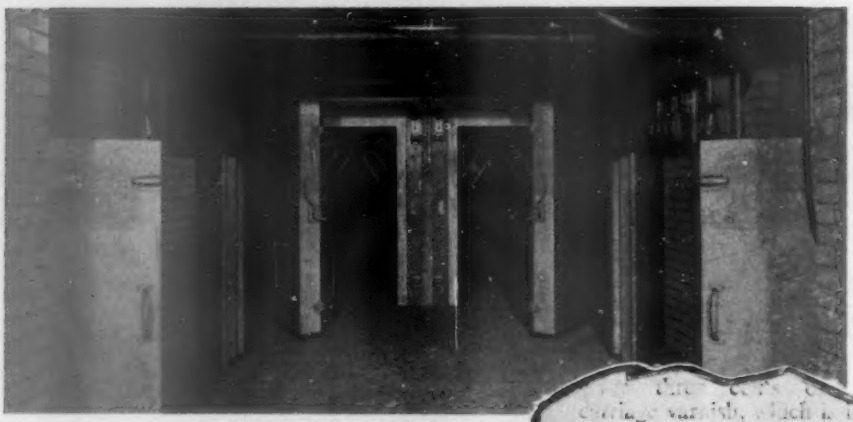

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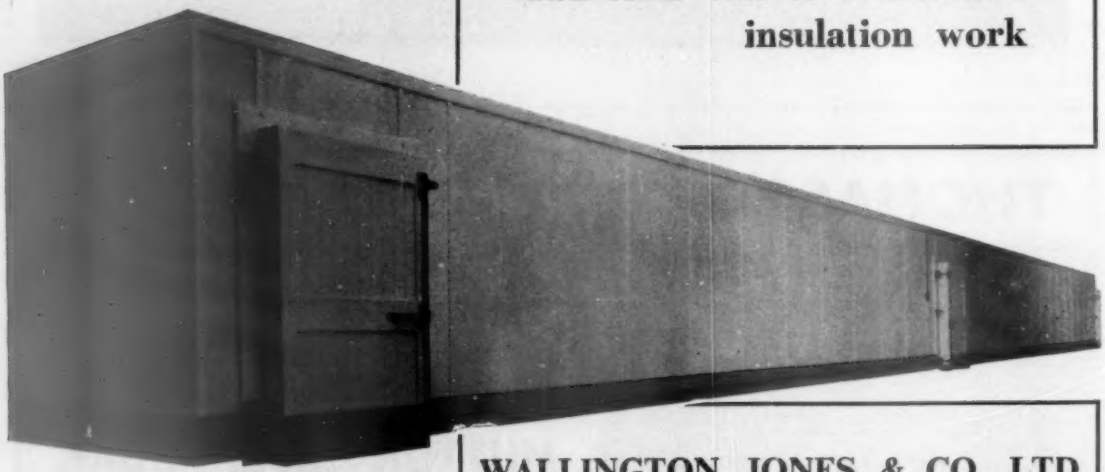

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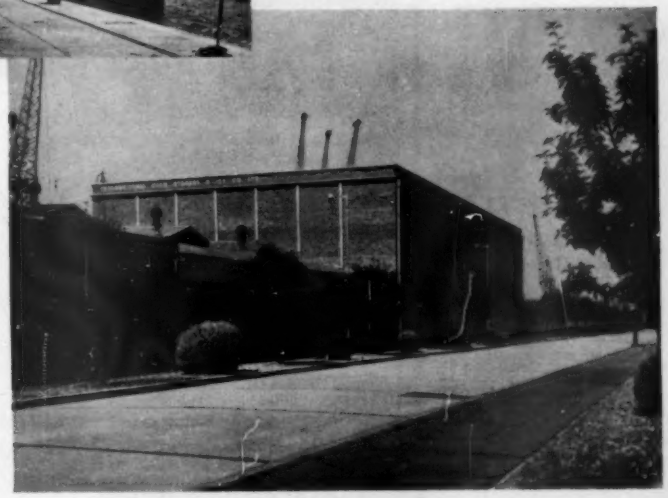

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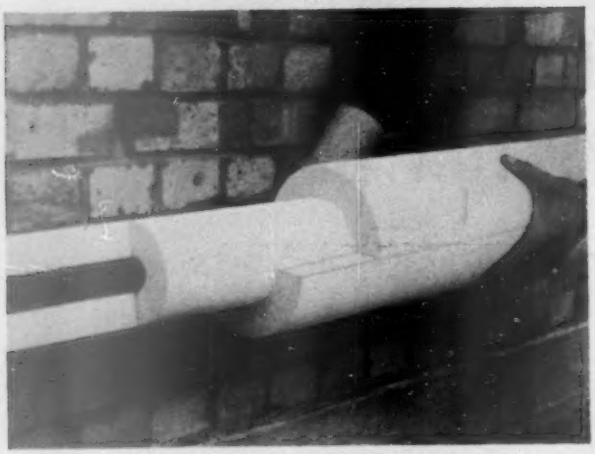

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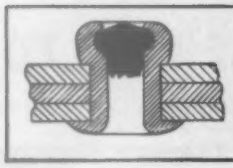

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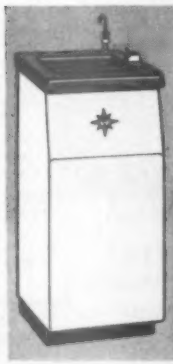

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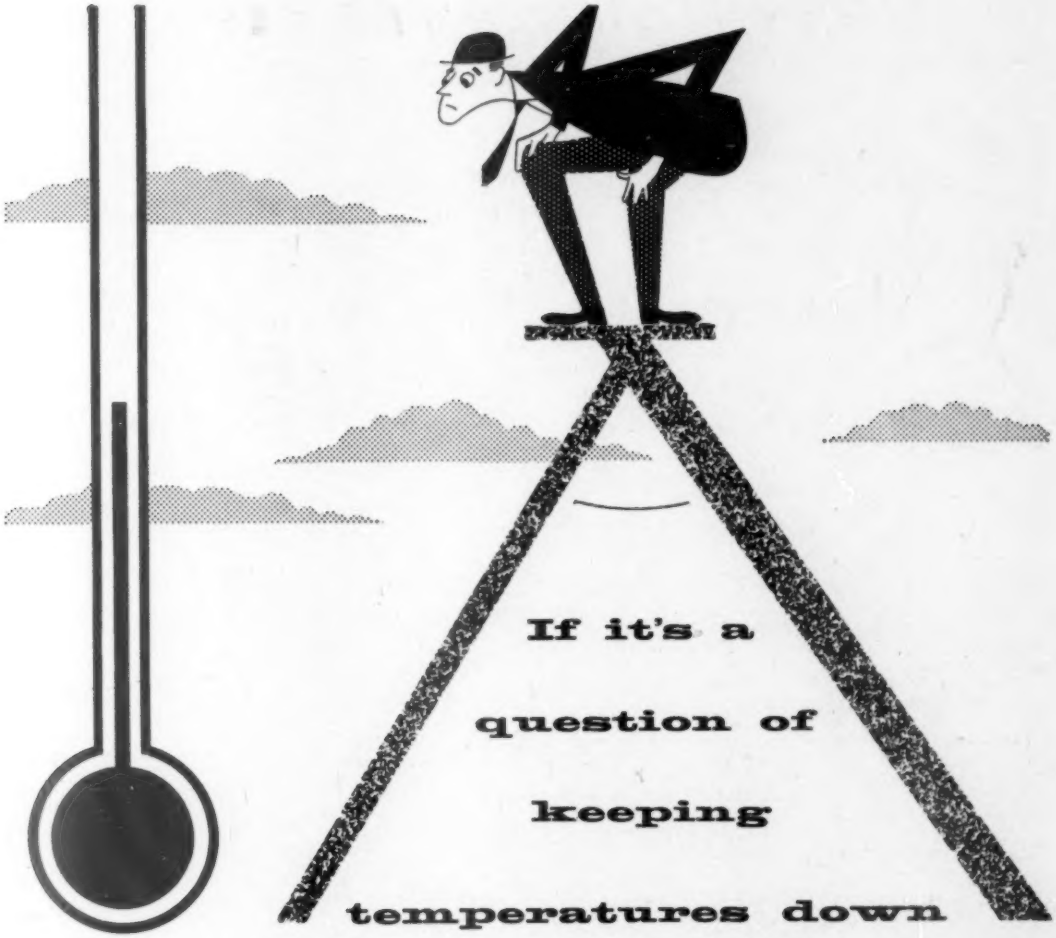

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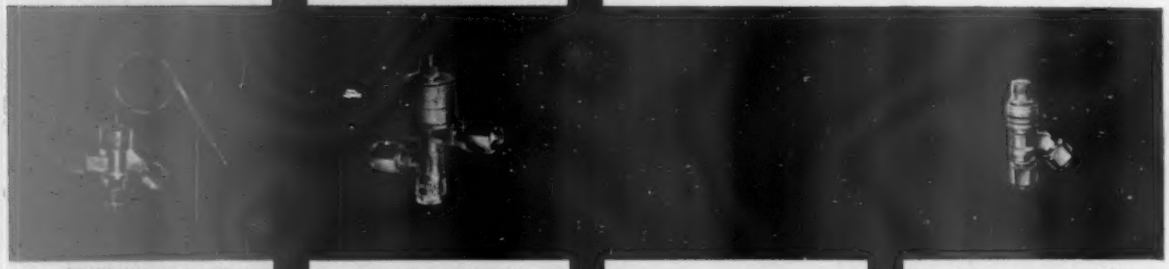

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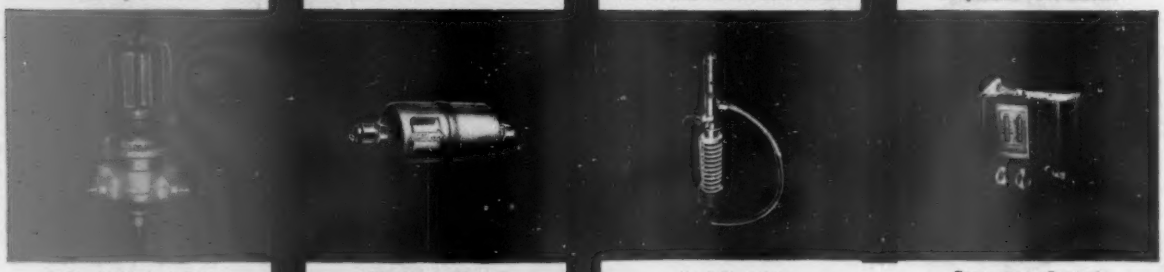

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